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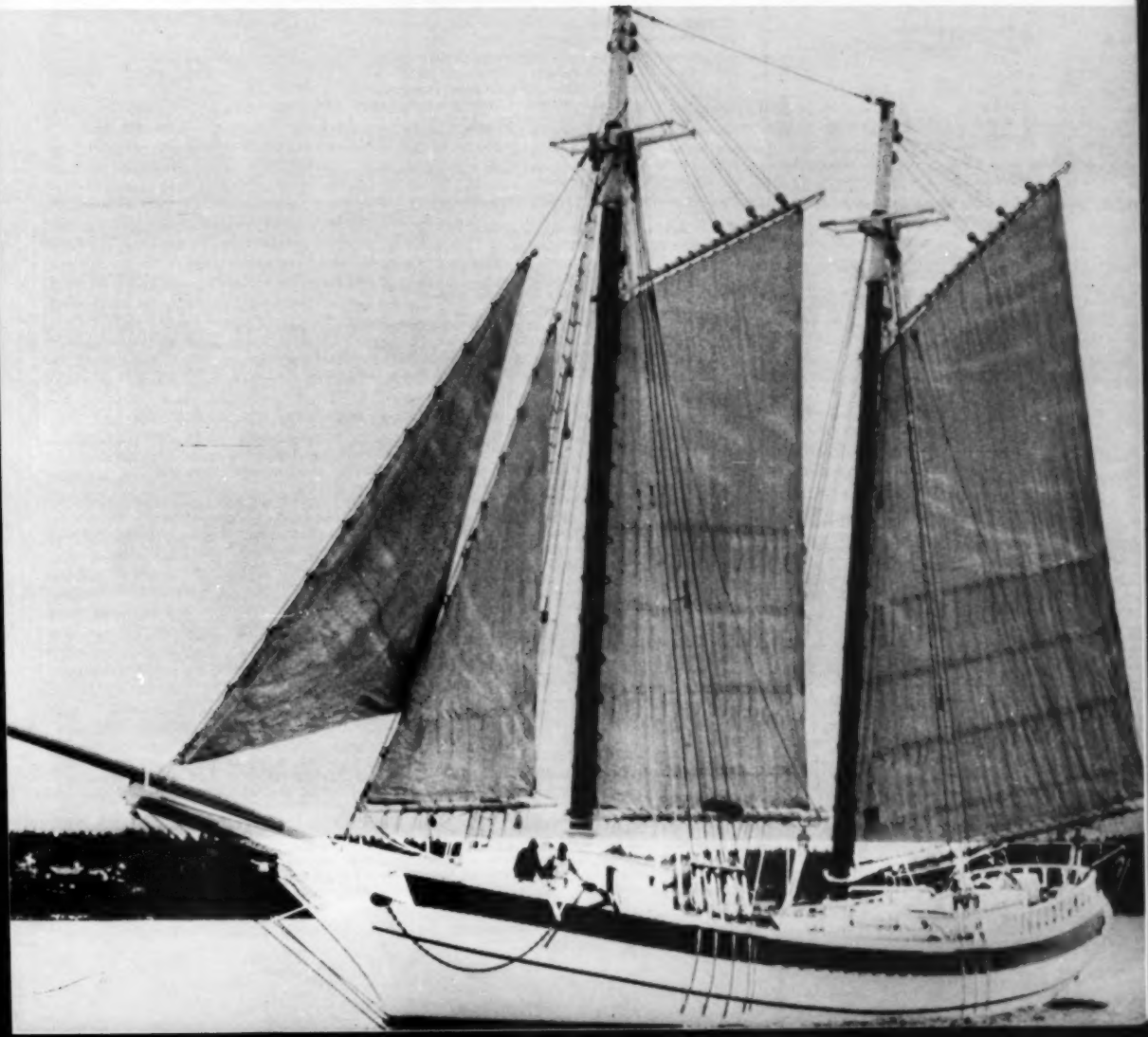

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Richard A. Frank, Administrator

ENVIRONMENTAL DATA AND INFORMATION SERVICE.
Thomas D. Potter, Director

Cover: The first commercial cargo schooner built in 40 yr, the JOHN F. LEAVITT, met with a sad fate, when it sank in a storm 280 mi southeast of Long Island on December 27, 1979. The vessel was on its maiden voyage from Quincy, Mass., to Haiti with oversized lumber. Crew and passengers were rescued by helicopter. For a description of the storm, see Rough Log, North Atlantic Weather, December 1979, on page 146. United Press International Photo.

Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

March 1980
Volume 24 Number 2
Washington, D.C.

Routing
Master _____

Observing Officers
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The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical approved by the Director of the Office of Management and Budget through June 30, 1980.

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Mariners Weather Log

ESTIMATION OF SURFACE PRESSURES FROM SATELLITE CLOUD PATTERNS

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The sparsity of weather data over oceanic regions often causes problems in analyzing surface weather charts. Intense cyclones can develop in the vast spaces between weather reports. Ship reports of strong winds and low pressures often are the first indication that marked development of a LOW has occurred. To supplement these reports and recognize the early stages of intense extratropical cyclones, a system using satellite imagery was developed to estimate the central pressure of extratropical surface LOWs.

With the launching of the GOES satellites in 1974, around-the-clock infrared satellite imagery became available for the first time. Since then, meteorologists in the Synoptic Analysis Branch of the National Environmental Satellite Service (NESS) and the Surface Analysis Branch of the National Meteorological Center (NMC) have used satellite data to locate frontal systems and low-pressure centers over data-sparse areas. These pictures have shown certain recurring cloud patterns in the evolution of a cyclone.

Early studies (Sherr and Rogers, 1965; Chang and Sherr, 1969; and others) proposed various models for the developing cloud patterns of extratropical cyclones. Although these studies stopped short of relating cloud patterns to quantitative meteorological parameters, they laid the groundwork for further investigation. A system for recognizing intensities of tropical cyclones was developed years ago (Dvorak, 1975), and today operational meteorologists around the world routinely estimate the central pressures and windspeeds of tropical cyclones by recognizing various cloud patterns on satellite pictures.

An attempt to develop a system similar to the Dvorak technique for extratropical cyclone development failed, when it tried to relate extratropical cloud patterns to surface windspeeds. Instead, the investigation showed that a useful relationship exists between the extratropical cloud patterns and the lowest observed surface pressure of a cyclone.

This investigation looked at developing cyclones in strong baroclinic zones (areas of large temperature gradients) defined by a broad band of multilayered clouds. The study was conducted during October through April, the season when temperature gradients are greatest, and baroclinic development is at its peak. Although the technique probably works during summer, the present system was developed for and should be used only during the period when winter-like systems prevail.

A simple procedure was used to develop the system. First, satellite pictures taken at synoptic times were studied. Pictures with the characteristic curving cloud patterns of a cyclone were compared to the corresponding NMC Northern Hemisphere surface analysis and the lowest observed pressure, usually a ship report, was located and drawn on the picture. These pictures were then grouped according to lowest reported surface pressures and separated into six groups of 10-mb increments between 1000 and 960 mb; i.e., LOWs in the 960- to 969-mb range, etc. Over 60 cases were used during the course of three winters (1976 to 1978) to develop the system. Distinct cloud patterns emerged for each pressure group, forming the basis of the present system. A new group of pictures was stacked according to the cloud pattern exhibited, and then a central pressure was estimated by meteorologists untrained in the system. Their estimate agreed remarkably well with observed pressures. Only pictures with conventional surface reports within 4 degrees of the center were used to form the data base.

When a wave first begins to develop, the band of clouds brightens and begins to bulge anticyclonically in response to a vigorous short-wave trough aloft. At this incipient stage of development, the cyclone's central pressure is usually more than 1000 mb. As the system continues to develop, the cyclonic bowing to the southwest of the center becomes very pronounced. As the pressures lower into the 990's, the first signs of a dry slot of clear air form on the rear edge of the

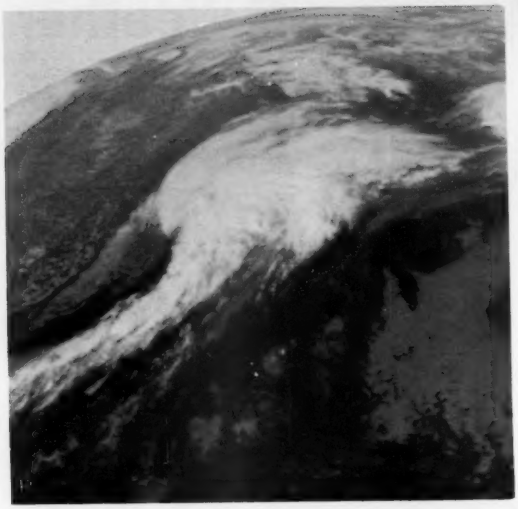

Figure 1.--SMS-II infrared imagery, 990- to 999-mb LOW. Note pronounced cyclonic bowing of cloud band.

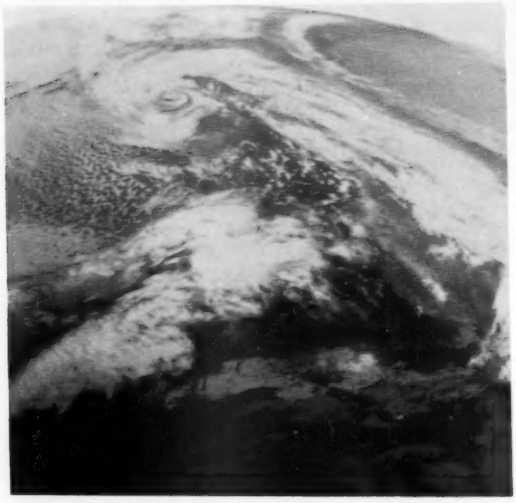

Figure 2.--SMS-II infrared imagery. When pressure nears 990 mb, dry slot starts to form. Note dry slot just to the left of point "A."

main mass of solid bright clouds. A V-shaped slot (figs. 1 and 2) is produced in response to cold advection and a sinking motion at the lower levels of the atmosphere. This intrusion of dry air is characteristic of a rapidly developing extratropical cyclone (Burt, Junker, 1976). When the slot becomes more pronounced, pressures lower.

As the low-pressure system continues rapid intensification, the upper-level circulation becomes more

Figure 3.--SMS-II infrared imagery, 980- to 989-mb pressure. Cloud band begins to form a hook around the center.

nearly vertically alined with the surface wave and the multilayered cloud band begins to wrap around the center of the LOW. When a distinct hook-shaped pattern first starts to emerge, the central pressure of the LOW dips into the high 980's (fig. 3). By the time the cloud band wraps one-half to three-fourths around the cyclone center, the pressure is approaching 980 mb.

The more fully the cloud band encircles the system's center, the lower the pressure. In the 970's, clouds wrap around the LOW almost one full time. During this stage of pattern development the storm's circulation center, defined by the hooking clouds, is located toward one edge of the cloud mass (usually the southern or eastern edge) with the heaviest clouds found to the north and west of the center (fig. 4). Occasionally, numerous cold-air convective showers occur over a widespread area to the west and south of the main cloud system. This indicates the possibility of extremely cold air aloft and an intense upper-level disturbance. These conditions suggest the storm may be deeper at the surface than the basic pattern implies.

When a cyclone's pressure drops below 970 mb, the cloud band wraps completely around the center 1-1/2 times. The more centrally located the circulation within the tight spiral cloud mass, the lower the pressure (fig. 5). Also, a circular cloud pattern around a center indicates a lower pressure, and elongated

Figure 4.--SMS-II infrared imagery, 970- to 979-mb LOW. Clouds hook around the center almost one full time.

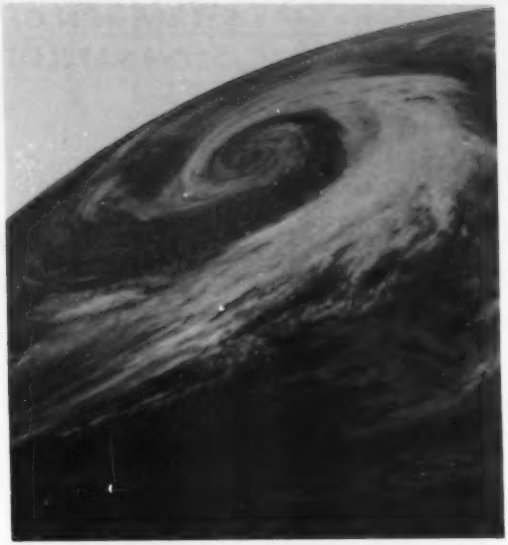

Figure 5.--SMS-II infrared imagery. At 960 mb and below clouds wrap around the LOW 1-1/2 times. The center becomes concentrically located within the clouds.

cloud patterns suggest less intense or filling Lows. Occasionally, the curvature of an intense LOW can be defined so tightly by spiral clouds that it almost defines an "eye" similar to that found in hurricanes. As the cyclone enters the mature stage, the cloud mass with tight curvature becomes dislocated from the baroclinic band. The center is still easily located by the curving bands. Here the cloud pattern begins to decay, but pressures often remain low. It is more difficult to estimate pressures of mature cyclones from satellite pictures, but these systems are usually well documented by many hours or days of analysis on the surface maps, and it becomes relatively easy to estimate whether mature cyclones are deepening or filling.

There are restrictions. The technique was developed for Northern Hemisphere extratropical cyclones in the polar westerlies during October through April using systems with strong multilayered baroclinic cloud bands. Almost every storm studied was north of latitude 40°N over oceanic regions; consequently, the technique should be applied only to similar storms.

CONCLUSIONS

The system is easy to learn. The only tools an individual needs to attain reasonably accurate estimates of a storm's intensity are infrared satellite pictures and an estimation chart (fig. 6). These pictures, routinely available on facsimile circuits, are easily accessible to interested mariners as well as the general public.

The technique should enable meteorologists analyzing surface charts not only to estimate a storm's central pressure, but also to construct pressure gradients around a LOW more accurately. In turn, better surface windspeed estimates are likely, which should lend to superior forecasts of ocean wave heights. Hopefully, these factors will help improve the quality of forecasts now available to ocean shipping.

This estimation method is by no means a finished product, and refinements to the present technique are likely. Operationally, evaluation of the current system and estimation of cloud patterns and surface pressures are continuing into this winter season, with sustained favorable results. However, the system is limited by its seasonality and applies only to a specific class of Lows. Hopefully, this technique can be expanded to include summer season storms and extratropical LOWs which are not baroclinic in origin.

Figure 6, the estimation chart appears on the following page.

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Sherr, P.E., and C.W. Rogers, 1965, The Identification and Interpretation of Cloud Vortices Using TIROS and Infrared Observation, Final Report, U.S. Weather Bureau (NWSC) Contract No. Cwb-10812, ARACON Geophysics Company.

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ESTIMATION OF SURFACE PRESSURE FROM SATELLITE CLOUD PATTERNS

USING THE SYSTEM:

1. Compare a cyclone's satellite cloud pattern to the various patterns found on the chart. Both the schematic representations and the pictured examples should be used when making a comparison.

2. Locate the pattern on the chart that most closely resembles the storm you are classifying.

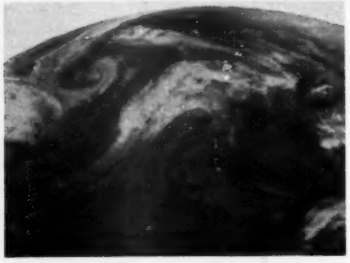
3. After the pattern is found, follow its column to the top until you locate a range of pressures. The lowest central pressure of the cyclone will fall within that interval.

4. Determine whether the cloud pattern of the cyclone looks stronger or weaker than the example earlier chosen. If the pattern is stronger, estimate a pressure which falls within the low side of the range. A weak appearance indicates pressures on the high end of the range.

Restrictions:

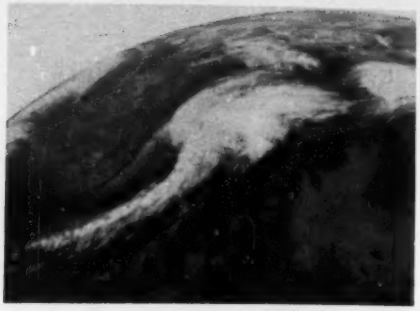
The technique was developed for extratropical cyclones in the polar westerlies over oceanic regions. The cases studied had strong baraclinic cloud bands and occurred during the months between October and April inclusive. The system should be applied only to similar types of storms and should not be used over land areas.

1000mb OR MORE



Low is usually not well defined on satellite picture. Multilayered cloud band shows only slight cyclonic-anticyclonic bowing.

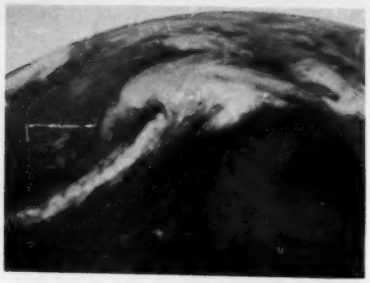
990mb-999mb



When pressures lower into the 990's the cyclonic bowing becomes more pronounced. By 990mb the cloud system begins to develop a dry slot.

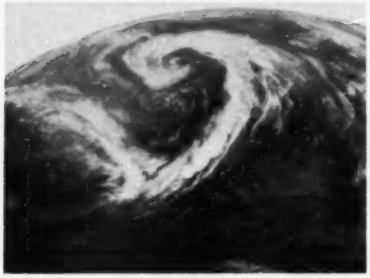
Figure 6.--Estimation chart of surface pressure from satellite cloud patterns. Continued on next page.

980mb-989mb



When systems deepen into the 980's the cloud band develops a distinct hook to the north and west of the surface low. By 980mb the cloud band wraps around the low 1/2 to 3/4 times.

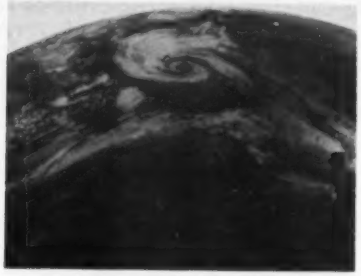
970mb-979mb



In the 970's the cloud band wraps around the low almost 1 full time forming a circle or oval. In most cases a weakness or break occurs in the clouds which form the circle. Usually the circulation center is located towards one edge of the circle usually to the south or east.

BELOW 969mb

960's and below: cloud band wraps around center $1\frac{1}{2}$ times with low and middle clouds sometimes filling in between the encircling cloud band. Circulation center is concentrically located within the circle formed by the clouds.



As cyclone enters the mature phase clouds become removed from the thick baraclinic band. Clouds often become mostly middle and high clouds, but sometimes the center is defined by lower clouds. The center is well defined located concentrically by the cloud bands.

Mariners Weather Log

NORTH ATLANTIC TROPICAL CYCLONES, 1979

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Miami, Fla.

The 1979 tropical cyclone season showed some signs of returning to what is considered normal; that is, lower latitude origins and tracks, more U.S. landfalls, and more intense hurricanes striking land areas in the western North Atlantic. There were eight named storms, five of which became hurricanes, and one subtropical storm this season. The most recent 30-yr average is 10 named storms and 6 hurricanes, so this past year continues the generally below-normal activity of the recent decade. This was the tenth consecutive year that the number of hurricanes has been average or below. Figure 7 gives the tracks of the 1979 named tropical cyclones and the subtropical cyclone, table 1 gives a statistical summary, and tables 2 and 3 show past years' data.

Even though there were fewer storms in 1979 than in 1978, the number of hurricane hours (each hour that a storm has windspeeds greater than 63 kn) reached 522. This was up markedly from last year's 307 and close to the 30-yr average of 620 hurricane hours. As one would expect, the large number of storms affecting the Gulf of Mexico, eastern Caribbean Sea, and the Atlantic seaboard also resulted in a larger number of ships reporting gale-force winds. There were 95 ships which reported winds of gale force on 144 observations received and plotted at the National Hurricane Center during the storms. Oddly enough, the only ship report of hurricane-force winds came from the KAPUSKASING as the subtropical storm crossed the North Atlantic shipping lanes on October 24.

Three ships had the misfortune to encounter more than one tropical cyclone this year. The American ship TEXACO WISCONSIN encountered Bob and David, the American ship EL PASO ARZEW encountered David and Gloria, and the Dutch ship WINSUM encountered Frederic and Gloria. However, dubious top honors go to the American ship WALTER RICE, which encountered David, Frederic, and Henri while traveling down the U.S. East Coast and through the Gulf of Mexico. Twenty-two ships reported gale-force winds more than once, with eight reporting gales more than three times, attesting especially to the large size of David and Frederic. Only the short-lived and minimal tropical storm Elena had no gale reports. Table 4 lists those ship reports of gale-force winds and high seas received this year.

The lull in landfalling U.S. and eastern Caribbean hurricanes ended this year. Bob affected New Orleans, David the Miami-Fort Lauderdale area northward to Savannah, and Frederic the Mobile, Ala.-Pascagoula, Miss., area. In addition, David devastated the Dominican Republic capital of Santo Domingo and seriously affected Dominica. The five landfalls of storms and hurricanes in the United States with three hurri-

Table 1.--Summary of North Atlantic tropical and subtropical cyclone statistics, 1979

No.	Name	Class	Dates	Maximum sustained winds (kn)	Lowest pressure (mb)	U.S. damage ($ million)[1]	Deaths
1	Ana	T	June 19-23	50	1005		
2	Bob	H	July 9-16	65	986	20	1-U.S.
3	Claudette	T	July 16-29	45	997	400	1-U.S. 1-Puerto Rico
4	David	H	Aug. 25-Sept. 7	150	924	320	5-U.S. 7-Puerto Rico 56-Dominica 1,200-Dom. Rep.
5	Elena	T	Aug. 29-Sept. 1	35	1004	< 10	2-U.S.
6	Frederic	H	Aug. 29-Sept. 14	115	943	2,300	5-U.S. 7-St. Maarten
7	Gloria	H	Sept. 4-15	85	975		
8	Henri	H	Sept. 14-24	75	983		
9	--	ST	Oct. 23-25	65	980		

T - tropical storm (winds 34-63 kn)
H - hurricane (winds 64 kn or higher)
ST - subtropical storm (winds 34 kn or higher)

[1] includes Puerto Rico and U.S. Virgin Islands

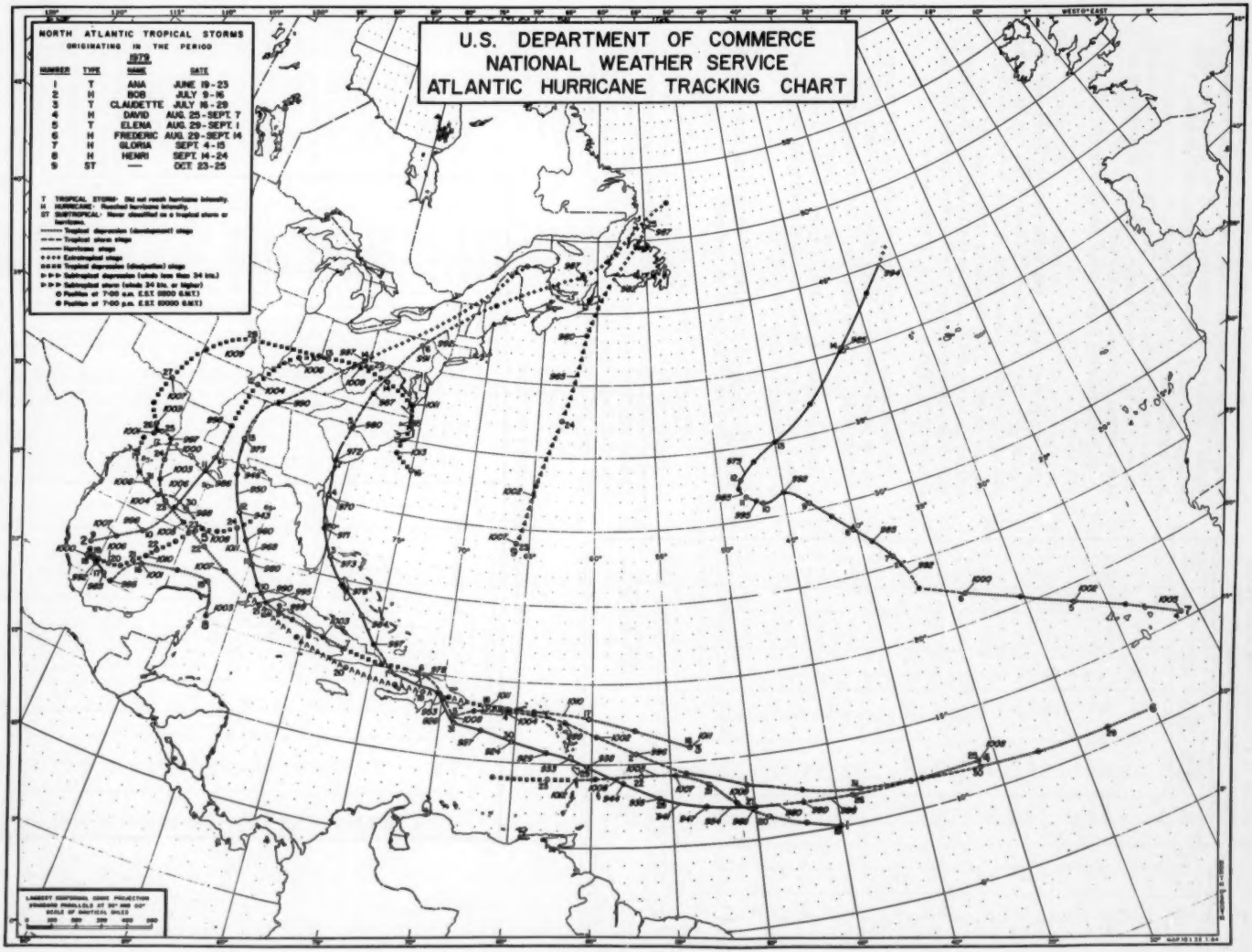

Figure 7. -- Tracks of North Atlantic tropical cyclones, 1979.

Table
NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

TOTAL NUMBER OF TROPICAL CYCLONES, LOSS OF LIFE AND DAMAGE								
Total Number Tropical Cyclones*			Total Number Hurricanes		Loss of Life		Damage by Categories**	
Year	All Areas	Reaching U.S. Coast	All Areas	Reaching U.S. Coast	Total All Areas	United States	Total All Areas	United States
1931	9	2	2	0		0		4
1932	11	5	6	2		0		4
1933	21	7	9	0		63		7
1934	11	5	8	2		17		6
1935	6	2	5	2		414		7
	58	21	33	12				
1936	10	7	7	3		2		6
1937	9	4	3	0		0		4
1938	8	4	3	2		600		6
1939	9	3	3	1		3		6
1940	8	3	4	2		51		6
	44	21	20	8				
1941	6	4	4	2		10		7
1942	16	2	4	2	17	6	7	7
1943	19	4	6	1	19	16	7	7
1944	11	4	7	3	1,075	64	6	6
1945	11	5	5	3	39	7	6	6
	84	19	25	11				
1946	6	4	3	1	2	0	7	7
1947	9	7	5	3	72	51	6	6
1948	9	4	4	3	24	3	7	7
1949	13	3	2	2	4	4	6	6
1950	13	4	11	3	27	19	7	7
	50	22	25	12				
1951	10	1	5	0	344	0	7	6
1952	7	2	6	1	16	3	6	6
1953	14	6	6	2	3	3	7	7
1954	11	4	8	3	720-	193	9	9
1955	12	5	9	3	1,510-	310	9	9
	54	18	37	9				
1956	8	2	4	1	76	21	8	7
1957	8	5	3	1	470	395	8	8
1958	10	1	7	6	49	2	7	7
1959	11	7	7	3	57	24	7	7
1960	7	5	4	2	165	66	8	8
	44	20	25	7				
1961	11	3	8	1	345	46	8	8
1962	8	1	3	0	4	4	6	6
1963	9	1	7	1	7,315-	11	9	7
1964	13	6	6	4	200	49	9	9
1965	6	2	4	1	70	75	9	9
	43	13	28	7				
1966	11	3	7	3	1,040	54	8	7
1967	9	3	6	1	86	16	8	8
1968	8	3	5	1	11	9	7	7
1969	18	3	12	2	3564	256	9	9
1970	10	3	5	1	74	11	9	8
	55	15	35	7				
1971	12	5	6	3	44	8	8	8
1972	7	3	3	1	128	121	8	9
1973	9	1	4	0	16	6	7	7
1974	11	3	4	1	3,000+	1	8	8
1975	9	1	6	1	89	31	9	9
	48	12	23	6				
1976	10	4	6	1	77	9	8	8
1977	6	1	5	1	19	0	7	7
1978	13	2	5	0	41	38	7	7
1979	9	3	5	2	1,200	53	9	9
Total	483	172	274	94				
Mean	9.9	3.5	5.6	1.7				

**The Environmental Data Service has for some time recognized that, without detailed expert appraisal of damage, all figures published are merely approximations. Since errors in dollar estimation vary in proportion of the total damage, storms are placed in categories varying from 1 to 9 as follows:

1 Less than $50	4 $5,000 to $50,000	7 $5,000,000 to $50,000,000
2 $50 to $500	5 $50,000 to $500,000	8 $50,000,000 to $500,000,000
3 $500 to $5,000	6 $500,000 to $5,000,000	9 $500,000,000 to $5,000,000,000

* Including hurricanes and other 1967 subtropical cyclones
\+ Not reported in literature, believed minor.
\- Additional deaths for which figures are not available.

canes and one major hurricane were near or above the long-term averages of three, two, and one, respectively. Nevertheless, the decade of the seventies had both the lowest number of landfalling hurricanes, 12, and landfalling major hurricanes, 4, in this century (Hebert and Taylor, 1979). The previous lowest totals were 14 and 5, respectively. Tables 5 through 8 list some of the meteorological data.

The outstanding features of the 1979 hurricane season were:

(1) hurricane David, the most intense hurricane of this century in the eastern Caribbean Sea, which devastated the island of Dominica, killing 56 and leaving 60,000 of the 80,000 residents homeless, and then killing an estimated 1,200 in the Dominican Republic with that country's government estimating damage in excess of $1 billion and 200,000 homeless;

(2) hurricane Frederic, which was the first hurricane to strike Mobile, Ala., since 1926, caused an estimated $2.3 billion damage in the United States;

(3) a reported 42 in of rain in 24 hr near Alvin, Tex., during Claudette, which if confirmed would be a U.S. 24-hr rainfall record; and

(4) the greatest combined damage total in the United States in 1 yr from tropical cyclones.

TROPICAL STORM ANA, JUNE 19-23

Mariners were probably surprised to hear advisories being issued on a tropical cyclone east of the Lesser Antilles in June. Ana was the first June storm to form east of the Lesser Antilles since 1933 and only the second during the past 100 yr. Ana de-

Table 3
NORTH ATLANTIC TROPICAL CYCLONES FOR PAST YEARS

Frequency of Tropical Cyclones (including Hurricanes) by Months and Years											Frequency of Tropical Cyclones Reaching Hurricane Intensity by Months and Years									
		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1931			1	1	2	3	1	1		9	1931	-								
1932		1			3	3	3	1		11	1932				2	1	1	1		
1933		1	1	2	7	5	3	1		21	1933		1	1	3	1	1			
1934		1	1	1	2	2	3	1		11	1934		1	1	1	1	1	1		
1935					1	1	2			4	1935				2	1	2			
1936			2	2	6	4	1			16	1936		1	1	3	2				
1937				1	2	6				9	1937					2				
1938					2	1	2	1		6	1938				2	1				
1939			1		1	1	2			4	1939				1		2			
1940		1			2	2	2			6	1940				2	1				
1941						4	2			6	1941					3	1			
1942					2	3	2	1		10	1942				2			1		
1943				1	2	4	3			10	1943			1	1	3	1			
1944				3	3	4	2			11	1944			2	1	3	1			
1945			1	1	4	2	2			11	1945		1			1	1			
1946			1	1	1	1	2			6	1946				1		1			
1947				1	1	3	3			8	1947					3	1			
1948				1	2	3	1	1		8	1948					1	3			
1949		1			3	7	2	1		15	1949					2	4	1		
1950					4	3	6			13	1950					4	3	4		
1951		1			3	4	2			10	1951	1				3	3	2		
1952	(Feb.) 1				3	2	2			7	1952					2	3	2		
1953		1			3	4	4	1	1	14	1953					3	3	1		
1954			1	1	2	4	1	1	1	11	1954			1		2	3	1	1	
1955				1	4	6	2			13	1955					3	3	1		
1956			1	1	1	4	1			8	1956				1	1		1		
1957					1	4	1			6	1957			1		2				
1958			1		4	4	1			10	1958					3	3	1		
1959		1	2	2	1	2	2	1		11	1959			1	2	2	3	1		
1960			1	2	1	2				7	1960				1	1	2			
1961				1		6	2	2		11	1961				1		6	1	1	
1962					2	5	1			8	1962					1	1			
1963				1	1	3	2			7	1963				1	1	1	1		
1964			1	1	4	4	1	1		12	1964					2	3	1		
1965			1		2	2	1			6	1965					2	3	1		
1966			1	4	1	4		1		11	1966			1	2	1	1		1	
1967					1	4	2			8	1967					1	3	2		
1968			2		1	3	1			6	1968			2		1	1			
1969				1	0	0	0	1		2	1969					0	2	1		
1970		1			3	5	2			10	1970	1				1	1			
1971			1	1	4	0	1	1		10	1971				2	2				
1972		1	1		2	2		1		7	1972			1	1	1				
1973				2	2	2	2			8	1973				1	1	1			
1974			1	1	4	4	1			11	1974				2	2				
1975			1	1	2	3	1		1	9	1975				1	2	3			
1976		1		1	0	2	1			10	1976				4	1	1			
1977					1	1	2			4	1977				1	0	1			
1978	(May) 1			1	4	3	2			12	1978				2	2	1			
1979			1	2	2	2	1			9	1979			1	2	2	2			
Totals	(Jan.) 2 (Feb.) 1	11	27	41	127	106	80	27	3	483	Totals	2	11	10	39	106	66	7	1	274

Table 4.--Ships encountering tropical cyclones in the North Atlantic during 1979

Call	Vessel Name	Nationality	Date	Position of ship		Time	Wind		Pressure	Sea Waves+		Swell Waves		
				Lat. Deg.	Long. Deg.	GMT	Dir. 10°	Speed (kn)	(mb)	Period (sec)	Height (ft)	Dir. 10°	Period (sec)	Height (ft)
ANA			JUN											
XCWU	DRAGAMINAS	MEXICAN	19	7.2	42.6	00	22	35	1011.6					
WLBO	AIMEE LYKES	AMERICAN	21	13.3	52.0	12	07	35	1008.0	06	10	07	9	13
DGMK	LLOYD NEW YORK	GERMAN	21	17.9	54.9	18	07	35	1017.0	05	11	09	9	13
BOB			JUL											
WHML	EXXON BOSTON	AMERICAN	11	26.4	89.7	00	15	35	1004.9	03	05	15	8	08
KLEZ	CVERSEAS ARCTIC	AMERICAN	11	27.8	92.8	00	06	35	1005.3	04	07	07	6	10
WIGK	TEXACO WISCONSIN	AMERICAN	11	25.7	86.2	12	18	35	1009.8	05	05	18	7	08
KIYP	EXXON LEXINGTON		11	26.2	87.1	12	17	35	1010.0	04	07	18	7	11
SHIP	SHIP		11	25.8	86.8	15	22	40	1008.8	05	08	22	5	13
CLAUDETTE			JUL											
LEVB	HOECH MERIT	AMERICAN	17	20.3	60.6	18	11	35	1016.7	05	03	10	14	16
SHIP	SHIP		18	20.1	62.7	00	12	40	1011.0		05			12
WLCI	DEL SOL	AMERICAN	22	27.7	85.4	12	15	35	1009.8	06	10	15	6	10
DAVID			AUG											
ELEM	DAVID PACKARD	LIBERIAN	29	16.0	57.8	12	09	35	1011.0	06	10	09	9	13
GVHU	CAUSEWAY	BRITISH	29	16.9	61.6	18	08	55	1002.5	10	25	08	14	33
6ZQC	ROBERTSBANK	LIBERIAN	29	18.6	62.0	18	07	35	1010.2	06	10	08	10	18
KVKV	AMERICAN TRADER	AMERICAN	29	17.0	66.2	18	07	40	1009.0	05	08	07	6	08
KKVA			30	19.9	65.2	22	10	35	1009.1	07	10	09	5	10
KVFN	AMERICAN HERITAGE	AMERICAN	31	17.1	64.7	03	10	35	1008.5	07	10	99	8	13
DIAW	HORNWIND	GERMAN	31	16.0	65.8	18	13	35	1006.6	03	07	13	5	13
			SEP											
H8EG			1	22.1	72.1	09	11	35	1006.0	10	07	10	12	08
H8EG			1	22.1	71.7	12	11	40	1007.2	07	11	10	10	16
H8EG			1	21.8	71.2	15	11	40	1007.5	04	08			
DGLU	LEVERKUSEN	GERMAN	2	23.1	72.0	12	12	35	1007.5	07	11			
KCGH	CAGUAS	AMERICAN	2	24.0	73.0	12	11	35	1010.0	05	10	12	7	20
KCGH	CAGUAS	AMERICAN	2	23.4	72.1	15	13	35	1010.1	05	10	12	7	20
GRNC			2	26.5	75.2	15	11	35	1011.9	04	05	09	6	10
SQDA	GENERAL SWIERCZEWSKI	POLISH	2	26.3	79.9	18	07	35	1008.3		10	07		10
HOOG			3	25.7	76.5	00	12	35	999.9		12			
HOOG			3	25.4	75.2	06	13	40	999.7		15			
WFJK	PUERTO RICO	AMERICAN	3	24.9	75.1	12	14	35	1009.1	08	05	13	5	07
PJSU	ROTTERDAM	DUTCH	3	27.3	76.9	15	12	40	1006.0	03	05	11	10	07
PJSU	ROTTERDAM	DUTCH	3	26.3	76.3	18	16	35	1008.1	08	03	16	8	13
WTER	RESEARCHER	AMERICAN	3	27.8	76.6	18	12	35	1007.8	04	10	12	8	20
PJSU	ROTTERDAM	DUTCH	3	25.9	77.3	21	18	35	1005.0	04	07	17	6	11
KFLF	MONMOUTH	AMERICAN	4	28.3	76.9	00	10	35	1000.7	10	15	16	9	20
SHIP	SHIP		4	26.0	76.4	00	15	40	1010.0	10	16	17	9	16
WZJG	AMERICAN ASTRONAUT	AMERICAN	4	25.4	75.6	00	12	35	1012.0	05	10	16	5	08
5LUR	TORRENT	LIBERIAN	4	27.9	78.8	00	15	35	1007.4					
WRGL	VALLEY FORGE	AMERICAN	4	27.6	79.7	00	18	50	992.8	07	11			
KALC	ARCO ENTERPRISE	AMERICAN	4	29.2	75.2	06	12	35	1011.5	08	16			
KALC	ARCO ENTERPRISE	AMERICAN	4	29.0	75.2	09	11	40	1010.8	08	15			
KALC	ARCO ENTERPRISE	AMERICAN	4	28.5	75.2	12	16	35	1012.7	08	15			
	DOLPHIN		4	25.7	76.0	12	12	40	999.6					
WJEN	ALEX STEPHENS	AMERICAN	4	27.0	79.7	12	22	35	1007.1	02	05	21	6	07
WMRU	MORMACLYNX	AMERICAN	4	28.9	77.0	12	16	40	1008.5	08	11	15	9	13
WRGL	VALLEY FORGE	AMERICAN	4	30.2	79.5	12	17	55	994.6	10	20			
GUQT	GYPSUM KING	BRITISH	4	31.2	77.0	12	14	45	1007.0					
WIGK	TEXACO WISCONSIN	AMERICAN	4	31.6	77.7	12	14	35	1004.7	02	05	14	6	23
KALC	ARCO ENTERPRISE	AMERICAN	4	28.1	75.2	15	14	35	1013.1	02	05	10	5	11
SHIP	SHIP		4	28.3	78.3	15	18	40	1009.0	08	10	19	9	15
WIGK	TEXACO WISCONSIN	AMERICAN	4	31.3	77.6	15	14	40	1005.1	03	07	14	5	25
JHJQ	NEW YORK MARU	JAPANESE	4	31.7	76.8	15	14	40	1011.0	05	10	15	7	16
KALC	ARCO ENTERPRISE	AMERICAN	4	27.6	75.9	18	03	35	1013.2	08	15			
WGED	MOBIL FUEL	AMERICAN	4	28.5	79.2	18	16	35	1007.8	12	16	12	14	16
UNXM			4	28.5	78.1	18	16	35	1008.6	04	05	15	8	11
WMRU	MORMACLYNX	AMERICAN	4	28.8	78.7	18	19	35	1008.8	08	11	19	9	11
WRGL	VALLEY FORGE	AMERICAN	4	30.8	79.2	18	17	50	999.7	01	20	17	11	20
WIGK	TEXACO WISCONSIN	AMERICAN	4	31.0	77.9	18	14	40	1004.4	04	08	15	12	33
WMRU	MORMACLYNX	AMERICAN	4	29.1	79.0	21	17	40	1006.4	08	11	19	9	13
WMRU	MORMACLYNX	AMERICAN	5	29.3	79.4	00	18	35	1006.4	07	10	18	8	13
WGEB	MOBIL FUEL	AMERICAN	5	30.1	78.4	00	17	45	1004.1	13	20			
WIGK	TEXACO WISCONSIN	AMERICAN	5	30.3	77.8	00	14	40	1005.1	04	08	15	12	33
GUZJ	GYPSUM BARON	BRITISH	5	33.1	75.3	00	14	35						
GUZJ	GYPSUM BARON	BRITISH	5	32.6	76.0	06	14	40	1013.0					
KMLK	EAGLE CHARGER	AMERICAN	5	31.6	75.6	12	16	35	1010.1	04	07	16	5	07
GUZJ	GYPSUM BARON	BRITISH	5	31.6	76.2	12	15	45	1014.0					
EIJP	IRISH CEDAR	IRISH	5	32.2	75.6	12	20	35	1014.7	03	05	15	8	15
GUQT	GYPSUM KING	BRITISH	5	30.3	79.1	12	35	40	1009.0					
ELDJ	MARCONA CONVEYOR	LIBERIAN	5	32.1	75.8	12	18	40	1013.8	08	13	18	10	13
WRGL	VALLEY FORGE	AMERICAN	5	33.2	77.8	12	19	40	1008.2	09	16			

+ direction of sea waves same as wind direction

Table 4 (con't). --Ships encountering tropical cyclones in the North Atlantic during 1979

Call	Vessel Name	Nationality	Date	Position of ship		Time	Wind		Pressure	Sea Waves+		Swell Waves		
				Lat. Deg.	Long. Deg.	GMT	Dir. 10°	Speed (kn)	(mb)	Period (sec)	Height (ft)	Dir. 10°	Period (sec)	Height (ft)
DAVID			SEP											
WRGL	VALLEY FORGE	AMERICAN	5	33.2	77.4	18	18	40	1011.9	09	16			
GUZJ	GYPSUM BARON	BRITISH	5	31.3	76.9	18	19	40	1016.0					
KHKB	EL PASO ARZEW	AMERICAN	6	36.5	74.7	06	17	35	1011.8		10	18		11
ELSA	CAPE MAGDALENA	LIBERIAN	6	38.0	74.7	12	17	35	1005.6	02	05	19	8	13
KCSE	WALTER RICE	AMERICAN	6	38.5	71.8	12	17	35	1010.0	05	10	17	9	13
A8CX	GOLD BOND CONVEYOR	LIBERIAN	6	40.6	72.5	18	20	40	1000.0					
GOUN	GLENPARK	BRITISH	7	46.3	55.0	12	20	35	1007.3	07	16	17	7	10
VCQQ	FREDERICK CARTER	CANADIAN	7	46.7	59.7	12	17	55	993.0					
VC2457	CRATENA	CANADIAN	7	44.0	64.6	12	27	35	999.0					
GGBV	SUGAR EXPORTER	BRITISH	7	48.7	63.6	12	35	35	984.6	05	08	09	6	10
ELENA														
NONE														
FREDERIC			SEP											
9VBG	MEDIOLANUM	SINGALESE	4	18.7	63.0	12	09	50	1010.5	09	20	09	9	20
PIQU	WINSUM	DUTCH	4	17.7	65.0	12	01	35	1002.2	06	13	99		13
DJLJ	LUTZ JACOB	GERMAN	4	16.5	64.7	12	34	45	1009.0	05	08	09	6	10
PIQU	WINSUM	DUTCH	4	17.2	64.8	15	09	35	1009.5	06	08	09	8	16
9VBG			4	19.5	62.3	18	13	45	1014.0	08	13	10	8	15
PIQU	WINSUM	DUTCH	4	17.7	64.5	21	11	35	1001.0	99	16			
PIQU	WINSUM	DUTCH	5	17.8	64.2	03	14	40	1012.0		16	99		16
PIGS	VIANA	DUTCH	5	18.9	65.6	15	12	35	1012.4					
SHIP	SHIP		5	17.6	67.7	18	11	35	1007.8	05	10			
SHIP	SHIP		9	23.4	83.4	21	02	35	1002.0		15			
KCKB	SUGAR ISLANDER	AMERICAN	10	24.4	82.6	18	09	45	1005.0	05	07	02	11	10
KHBA	EXXON HOUSTON	AMERICAN	10	24.5	83.9	18	12	35	1005.8	06	05			
KCSE	WALTER RICE	AMERICAN	10	24.8	84.7	18	06	35						
H3AU	GLOBAL FRONTIER	PANAMANIAN	10	26.7	83.5	18	09	35	1006.7	11	07	09	8	10
3FNO			10	24.5	84.2	21	07	50	1000.3					
KIYO			11	24.7	81.4	00	09	35	1006.4	11	08			
6ZDJ	RALPH B. JOHNSON	LIBERIAN	11	24.8	83.7	00	08	35	1002.0					
KHBA	EXXON HOUSTON	AMERICAN	11	24.7	83.6	00	11	50	1000.5	05	05	11	5	08
SHIP	SHIP		11	24.0	82.7	06	14	40	999.5					
IBOK			11	22.3	82.7	12	10	35	1004.0	05	10			
KHBA	EXXON HOUSTON	AMERICAN	11	24.4	83.2	12	12	45	1000.0	05	07	23	9	10
KHFE	HESS VOYAGER	AMERICAN	11	26.0	84.4	12	04	35	1002.5	04	16	04	14	16
KCKB	SUGAR ISLANDER	AMERICAN	11	25.7	85.5	12	04	40	1001.0	06	18	08	6	16
PDCU	BILDERDYK	DUTCH	11	26.3	86.1	12	05	35	1005.5	06	13	08	9	16
WHLC	OVERSEAS ULLA	AMERICAN	11	22.8	85.9	12	34	50	1001.5	05	07	34	6	16
SFAK	FIN CLIPPER	SWEDISH	11	24.7	82.7	15	13	35	1004.0	09	16			
PDCU	BILDERDYK	DUTCH	11	27.5	87.5	18	05	35	1005.9	05	00	09	10	15
ELDJ	MARCONA CONVEYOR	LIBERIAN	12	25.6	82.3	00	13	40	1003.0	06	07	20	10	13
DEHD	HAMMENTOR	GERMAN	12	25.4	83.4	00	14	35	1003.3	07	15	09	11	16
SHIP	SHIP		12	26.3	86.7	00	01	40	1000.5	04	13	01	5	15
9VBG	MEDIOLANUM	SINGALESE	12	25.7	87.3	03	32	35	1003.5		10			15
D5NA	FIRMNES	LIBERIAN	12	24.5	83.1	06	16	35	1005.0					
	DEPENDABLE		12	25.2	86.0	06	22	35	997.0					
WHLV			12	24.8	86.7	06	29	45	1004.1	08	08	12	9	13
5MUC			12	26.2	84.6	12	15	40	1003.1	07	18			
WHLC	OVERSEAS ULLA	AMERICAN	12	25.2	86.6	12	20	35	1006.4	07	10	22	8	10
WHLC	OVERSEAS ULLA	AMERICAN	12	25.7	86.8	15	24	40	1007.2	06	08	24	8	11
WHLC	OVERSEAS ULLA	AMERICAN	12	25.8	86.7	18	24	40	1006.5	07	08	27	8	11
KHBA	EXXON HOUSTON	AMERICAN	12	25.4	86.8	18	21	35	1003.7	07	08			
CSAI	LAROUCO	POLISH	12	27.2	88.4	18	33	40	995.0					
WHLC	OVERSEAS ULLA	AMERICAN	13	27.1	86.3	00	23	35	1007.8	07	11	23	8	13
GLORIA			SEP											
IBRH	DA MOSTO	ITALIAN	7	25.6	36.5	09	14	40	1000.9	09	33			
GTOZ	WILD FLAMINGO	BRITISH	8	28.3	38.9	18	13	35	1015.3	05	15	13	9	20
GTOZ	WILD FLAMINGO	BRITISH	8	27.7	39.0	21	14	35	1015.7	05	15	13	9	20
PIQU	WINSUM	DUTCH	10	29.5	45.2	15	26	35	1012.2	06	10	36	8	
5BFS			10	34.7	44.3	18	19	35	1017.0	05	11	10	14	11
FNXB	FORT PONTCHARTRAIN	FRENCH	10	29.2	46.2	21	23	40	1010.6	05	08	32	7	08
KHKB	EL PASO ARZEW	AMERICAN	11	33.7	48.7	00	07	40	1014.8					
KHKB	EL PASO ARZEW	AMERICAN	11	34.4	45.4	12	10	35	1018.1	03	05	10	7	07
KNOL	SUSQUEHANNA	AMERICAN	14	36.7	33.9	15	19	40	1010.8	99	08	99		18
DEAE	DELTA GAS	GERMAN	14	39.3	34.7	15	23	40	1005.5	08	18	23	8	20
DEAE	DELTA GAS	GERMAN	14	39.4	34.6	18	24	35	1008.0	08	18	23	8	20
GUHK	ANCO ENDEAVOR	BRITISH	15	40.3	37.5	00	30	40	1012.2	04	07	34	6	20
HENRI			SEP											
KCSE	WALTER RICE	AMERICAN	16	23.7	90.7	12	11	40	1006.8	05	08	11	10	15
3ERY			18	21.5	96.5	04	32	60	1005.6		40			
SHIP	SHIP		18	21.1	96.8	09	34	40	1002.1		35			
SHIP	SHIP		18	20.8	96.7	12	30	35	1004.0		30			
SUBTROPICAL STORM			OCT											
WFGT	EXPORT BANNER	AMERICAN	24	39.2	56.2	18	17	40	1008.2	05	10	15	8	15
CGCK			24	40.5	61.1	18	16	65	990.1	08	21	17	8	20
LDRV			24	39.8	61.2	18	16	45	995.0					
YTUV			24	39.1	63.7	18	28	50	998.5	07	15			
CZGL			24	41.3	61.2	18	09	35	1003.9	05	08	10	9	13
HOHB	PEARL ACE	PANAMANIAN	24	41.7	60.1	18	14	45	995.4	03	03	14	7	20
CGLL			25	40.2	61.0	00	24	40	1002.9	08	16	13	8	15
HOHB	PEARL ACE	PANAMANIAN	25	42.1	58.1	00	20	45	997.5	05	05	19	7	20

+ direction of sea waves same as wind direction

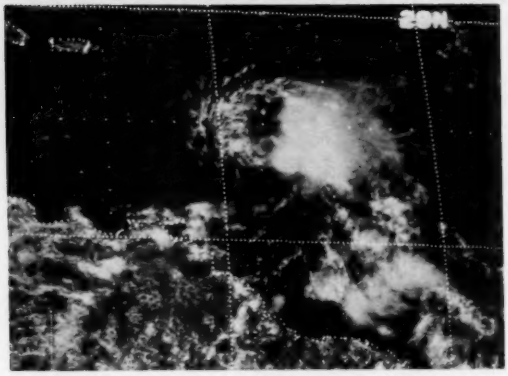

Figure 8.--Anna at peak intensity on June 22.

veloped a few days earlier than the 1933 storm, which developed somewhat farther to the east of the islands.

The first evidence of something unusual came on the 19th at 0000 when the Mexican ship DRAGAMINAS reported southwest winds of 35 kn near 7.2°N, 42.6°W. Satellite pictures the next morning indicated that a depression was forming near 10°N, 45°W. Postanalysis showed that Ana reached tropical-storm strength about 0000 on June 22. However, the storm was not named until 1600, when the first reconnaissance flight indicated winds of 50 kn (fig. 8). Gale warnings were then issued for the islands from Martinique to Guadeloupe because of the proximity of the storm. Strong westerly winds at high levels separated the convective energy source from the low-level circulation center, however, and Ana weakened to a minimal tropical storm before passing through the islands during the evening of June 22. Further weakening took place, and Ana degenerated into a tropical wave in the eastern Caribbean Sea early on the 24th.

There were no reports of gale-force winds or heavy rains in the islands and no deaths or damage.

HURRICANE BOB, JULY 9-16

Bob developed from one of the many disturbances that originate over Africa each year. He was the first of five named storms in the Gulf of Mexico during 1979. A depression formed in the southwest Gulf of Mexico on July 9 and began moving northeastward in advance of a low-pressure trough approaching from the west. Reconnaissance reports indicated the depression had reached tropical-storm strength the next morning, and gale warnings were issued at 1600 for the central Gulf Coast from Vermilion Bay, La., to

Table 5.--Meteorological data, hurricane Bob, July 9-16, 1979

Location	Date	Pressure (inches) Low	Time*	Fastest Mile	Time*	Wind (mph) Peak Gust	Time*	Tide (ft) Highest MSL	Time*	Rainfall (inches) Storm Total	Dates
Louisiana											
Buoy 26.0N 90.0W	10	29.65	1900	S 37	1700						
Buoy 26.0N 93.5W	10	29.69	1700	NNE 30	1400	38					
Mobil Oil Rig 28.2N 91.8W	11	29.37	0300	N 45	0200						
Mobil Oil Rig 28.3N 93.0W	11	29.45	0300	N 23	0200						
Mobil Oil Rig 28.5N 90.1W	11	29.33	0300	S 63	0300						
Mobil Oil Rig 28.7N 92.3W	11			NW 30	0300						
Grand Isle CG	11	29.32		SE 58	0600	SE 63	0600	3.8#			
Morgan City										3.88	10-11
Boothville WSMO	11	29.52				SE 53	0430				
Lafayette FSS	11	29.66		18						0.12	10-11
New Orleans WSMO	11	29.28		SE 44	0837	SE 60	0811			2.76	10-11
New Orleans FSS	11			35		S 58	0251				
Belle Chase NAS	11	29.37		31		51				2.21	10-11
Slidell WSFO	11	29.44								3.30	10-11
Lake Pontchartrain											
West end	11							2.9			
Mandeville	11							5.1			
Industrial Canal	11							2.6			
Rigolets	11							3.8			
St. Charles Parish CD	11					60					
Norco	11	29.22									
Baton Rouge WSO	11	29.57	1430	21	1451	38	1447			2.74	10-11
Mississippi											
Bay St. Louis	11	29.58	1000			SSE 64	1000	5.0#			
Gulfport	11	29.22		SE 55		S 60		6.3		3.75	
Harrison County CD	11	29.23	1420			63	1400	6.3		5.85	
Biloxi Backbay	11							5.2			
Pascagoula Churn	11			S 25		S 53	1225	.			
West Pascagoula River								3.4			
East Pascagoula River								4.2			
Columbia	11					55					
Jackson WSFO	11	29.42	1455	26	1440	38	1427			2.27	11
Alabama											
Dauphin Island Churn	11	29.78	0700			S 52	1027				
Dauphin Island Sea Lab	11	29.75	0900	31	1144	50	1144			1.50c	
Mobile WSO	11	29.75	1253	32	1355	41	1109			1.97	
Mouth of Mobile River	11							4.2	1110		
Indiana											
Spencer										5.21	13
Princeton										3.63	13

*Central Standard Time
cEstimated
#Above Normal

Note: Data in table is based on information available and may not represent extreme values which occurred.

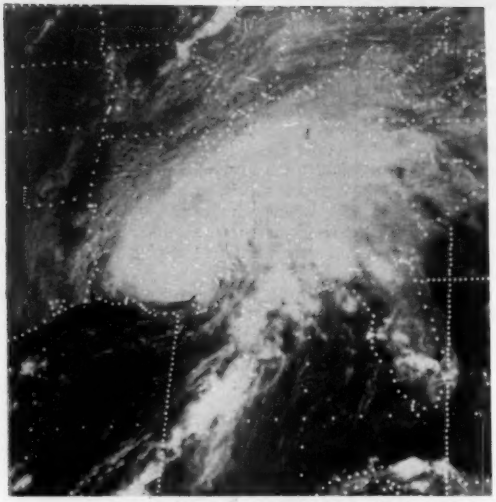

Figure 9.--Bob is inland over Louisiana at 1700.

Biloxi, Miss. Bob was upgraded to a hurricane at 2200 on July 10 as winds reached 65 kn. He was the first July hurricane in the Gulf since 1959.

The storm's center crossed the Louisiana coast near Grand Isle about daybreak on the 11th, passing just west of New Orleans later that morning, and weakening rapidly after crossing Lake Pontchartrain (fig. 9). The remnants of Bob produced some flooding from locally heavy rains in southern Indiana and Ohio and West Virginia.

Along the coast the statistics associated with Bob were typical of a minimal hurricane. The maximum sustained winds of 65 kn and minimum pressure of 986 mb occurred about the time of landfall. Highest measured winds on the coast were 45 to 55 kn with a few gusts to 65 kn. Tides were generally 3 to 5 ft above normal from the landfall point eastward to Mobile Bay (fig. 10). Rainfall totals were between 3 and 4 in. Eight tornadoes were reported but only one, in Biloxi, Miss., produced significant damage. There was one death in Louisiana. Coastal damage was less than $5 million, but it exceeded $15 million in the Indiana floods.

TROPICAL STORM CLAUDETTE, JULY 16-29

Claudette was a tropical storm for two brief periods separated by a 5-day interval during which she weakened to a disorganized wave. A surface circulation was first evident on July 16 about 450 mi east of the Leeward Islands. A reconnaissance aircraft indicated that winds had reached 45 kn the next morning, and the depression was upgraded to tropical storm Claudette at 1600, even though the minimum sea-level pressure was 1011 mb. As had been the case with Ana, gale warnings were required in the first advisory because of the proximity of the storm to the islands, this time for the Leeward Islands, the Virgin Islands, and Puerto Rico. This was the third consecutive storm in which gale warnings were issued in the first advisory. Once again, however, strong high-level westerly winds caused Claudette to weaken to a depression over Puerto Rico and to a tropical wave over Hispaniola. Some flooding resulted from 7 to 8 in of rain over Guadeloupe,

Figure 10.--Shrimpboats and cars feel the fury of hurricane Bob at Biloxi, Miss., on the 11th. Wide World Photo.

Table 6.--Meteorological data, tropical storm Claudette, July 16-29, 1979

Location	Date	Pressure (inches) Low	Time*	Wind (mph) Fastest Mile	Time*	Peak Gust	Time*	Tide (ft.) Highest MSL	Time*	Rainfall (inches) Storm Total	Dates	Remarks
Lesser Antilles												
Martinique	17			SSE 35	1550					2.72		
Guadeloupe	17									7-8		
Antigua	17					52				2.30		
Barbuda	17					46						
Puerto Rico												
Ponce										8.06	17-18	
United States												
Texas												
Beaumont-Port Arthur WSO	24	29.46	1705	53	25/0518	60	25/0521	2-4c#		12.75	23-26	
Port Arthur										16.84	24-27	
Sabine CG	25							4-5c				
Galveston WSMO	24	29.66	1813	NE 20	23/1859	NE 33	23/1251	3.8	23/0630	16.95	25-26	
Baytown										14.24	25-26	
Texas City	23							3.5		12.58	25-26	
Houston Int'l Airport										2.83	25-26	
Alvin WSO										30.70	24-27	
Sargent										34.50	24-27	
Freeport	26			SSW 48	0600			3.1		30.20	24-27	
42 S Freeport	25					45-60c	0750					
Louisiana												
Cameron	24	29.56	1615			50-60c	1415	3.9c	1040			
Lake Charles	24	29.61	1700	S 28	25/0226	39	25/1058	4.0		9.18	23-26	
Mobil Oil Rig 28.3N 93.0W	24			S 46	1000							
Mobil Oil Rig 28.7N 92.3W	24			SE 52	0600							
Mobil Oil Rig 28.2N 91.8W	24			SSE 40	0600+							
Conoco Oil Rig 29.3N 93.0W	25			S 50	2325							

*Central Standard Time
cEstimated
#Above Normal
+First of Several Occurrences

Note: Data in table is based on information available and may not represent extreme values which occurred.

and amounts exceeding 9 in in southern Puerto Rico caused one death and an estimated $750,000 damage from river floods.

Part two of tropical storm Claudette began as the tropical wave remnants moved into the southeastern Gulf of Mexico on the morning of July 21. A depression formed later that day and reached tropical-storm strength on the 23d. Once again, gale warnings were issued with the first advisory at 1300 from Biloxi, Miss., to Freeport, Tex. The center of Claudette was poorly defined and elongated in a north-south direction. The storm had been moving steadily towards the northwest, and late on the 23d it appeared that it had weakened to a depression again. Gale warnings were discontinued. However, a dominant center formed to the north and began drifting northward shortly before daybreak on the 24th. Offshore oil rigs began reporting gale-force winds, and gale warnings were issued once again at 1430, this time from Grand Isle, La., to Galveston, Tex. The center crossed the coast near the Texas-Louisiana border about 1800 and was expected to continue northward and spread heavy rains through the lower Mississippi Valley. The development of a high-pressure system aloft to the north of the center blocked Claudette and caused it to turn slowly toward the west, describing a tight loop over extreme southeastern Texas during the next 24 hr, before finally moving off to the north (fig. 11). Claudette did not weaken because of the proximity of the center to the water, and offshore oil rigs reported winds of gale force for 30 hr after the center moved inland. Claudette's lowest central pressure of 997 mb occurred at Beaumont, Tex., after the center had moved inland. Maximum sustained winds of 45 kn were observed by reconnaissance aircraft east of the Leeward Islands and in the northwestern Gulf of Mexico.

In spite of her disorganized life, Claudette will be remembered along coastal southeastern Texas for the torrential rains which occurred while the center was making a loop in that area (fig. 12). An unofficial report of 42 in of rain in 24 hr from an observer near Alvin, Tex., will be a U.S. 24-hr rainfall record if verified. There were also several reports of storm rainfall exceeding 30 in from Alvin, Freeport, and Sargent, Tex., making Claudette one of the wettest

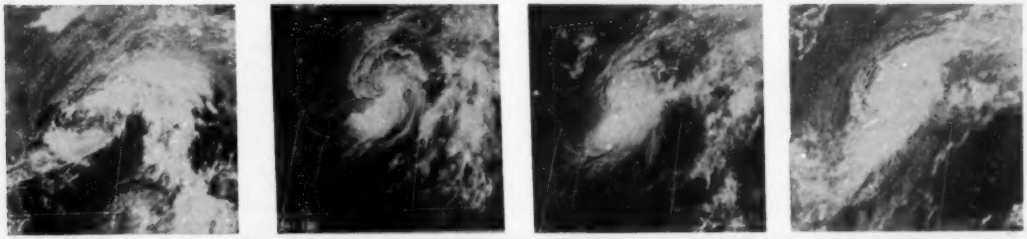

Figure 11.--GOES 1 satellite catches the record flood-producing Claudette lingering around Texas during July 23 to July 26.

Figure 12.--Walking, boating, and riding, Houston residents flee by all means available during the devastating floods in the wake of Claudette. Wide World Photo.

tropical cyclones ever to affect the United States.

The highest winds on the coast were estimated to be 45 to 55 kn in gusts at Cameron, La., around the time of landfall. Tides of 2 to 4 ft above normal caused minor damage along the Louisiana coast. There was one death in Texas attributed to Claudette, and damage from the flooding produced by her heavy rains will likely exceed $400 million.

HURRICANE DAVID, AUGUST 25-SEPTEMBER 7

David was the most intense hurricane of this century to affect the islands of the eastern Caribbean Sea. The central pressure of 924 mb while south of Puerto Rico on August 30 is the lowest measured central pressure in that region. David may be regarded as a typical Cape Verde hurricane. Characteristics of this type of hurricane are:

(1) attaining hurricane intensity well east of the Lesser Antilles;

(2) following a parabolic track around the periphery of the Azores-Bermuda High and frequently affecting the Lesser Antilles, the Greater Antilles, and the United States;

(3) maintaining major hurricane intensity for the duration of the hurricane, unless weakened by landfall; and

(4) expanding in size with movement to higher latitudes to become both large and intense before reaching the United States.

In David's case, this trajectory resulted in an impact on a large number of people both on land and at sea. Hurricane warnings were posted in advance of the center for most of the Lesser Antilles, Puerto Rico, Hispaniola, the Bahamas, and from the middle Florida Keys northward to southern North Carolina. Gale warnings were extended ahead of the inland storm from North Carolina northward to Eastport, Maine. Historically, there have been few storms whose effects were so widespread.

While many ships were affected by David's 2-week journey, the Liberian ROBERTSBANK and the British CAUSEWAY had the dubious distinction of accompanying the developing David from the African coast to the Leeward Islands. The ships frequently reported easterly winds of 30 kn and 8-ft seas, but they did not report winds of gale force until the strengthening David had reached the islands. David had 210 hurricane hours, mostly at sea, and accounted for 68 gale-force observations or about half of the total for 1979.

David was the most intense hurricane of the season. Maximum strength of 150 kn and minimum pressure of 924 mb were reached south of Puerto Rico on August 30 (fig. 13), but there was little difference in strength when David struck Dominica and Santo Domingo. He was the strongest hurricane at Dominica since 1834 and at Santo Domingo since 1930. David was not a major hurricane when it struck the United States. The

Figure 13.--Looking down the eye of David as it hits the coastline of the Dominican Republic near Santo Domingo.

landfall pressure of 972 mb just north of Palm Beach, Fla., around midday on September 3 and estimated winds of 85 kn changed little before the second landfall near Savannah Beach, Ga., approximately 24 hr later. Savannah reported a minimum pressure of 970 mb.

Figure 14.--This was once a lovely tree-lined avenue near the ocean front in Santo Domingo. Wide World Photo.

Figure 15.--High waves from hurricane David lash the shore and Hillsborough Inlet Light at Fort Lauderdale, Fla., on September 3. Wide World Photo.

Table 7.--Meteorological data, hurricane David, August 25 - September 7, 1979

Location	Date	Pressure (inches) Low	Time*	Wind (mph) Fastest Mile	Time*	Peak Gust	Time*	Tide (ft.) Highest MSL	Time*	Rainfall (inches) Storm Total	Dates	Remarks
Lesser Antilles												
Barbados (Seawell)	28	29.58	2300	S 29	29/1000	S 40	29/1600					
Martinique (Fort-De-France)	29	29.38	1000	W 52	1000	SW 62	0900					
Dominica (Roseau)	29					94§	1045			8.50§		Calm 1430-1500
Guadeloupe (Le Raizet)	29			NE 52	1200	NE 64	1200					
Antigua	29					58				2-3		
Montserrat	29					70-80c						
St. Maarten	29	29.76	2000			60	1805			1.82	29-31	
Puerto Rico and U.S. Virgin Islands												
St. Croix										11.55	8/30-9/1	
St. Thomas										6.03	8/30-9/1	
Puerto Rico												
San Juan	30			ENE 34	0800	ENE 43	0800			2.19	8/30-9/1	
Magueyes Island (S.W. Coast)	30					70-80c				19.90	8/30-9/1	
Dominican Republic												
Santo Domingo	31			100-125c								
Bahamas												
Georgetown, Exuma	2	29.46	0700	E 52	0700							
Kemps Bay, Andros	2	29.47	1300	NNE 69	1300							
West End, Grand Bahama	3	29.30	0655	ESE 46	0655							
Nassau, New Providence Is.	2	29.47	1045	E 48	1345	ENE 64	1245					
United States												
Florida												
Key West WSO	3	29.58	0500	N 26	0357	NE 39	2/1156	0.8**	0634	0.03		
Key West CG	3			N 25		N 36		1.0#				
Marathon CG	3			25		35						
Islamorada	3			30		40		2.0#				
Miami WSMO	3	29.33	0652	WSW 30	3/1050	44						
Miami CG	3	29.50				NE 58						
Miami Beach	3			NE 58	0300	69						
West Palm Beach WSO	3	28.87	1020	N 58	3/0925	N 75	3/0942	1.5		2.17	2-4	
Sikorsky ACFT	3					83				5.00	2-4	
Port Mayaca	3					80						
Canal Point	3					70						
Clewiston	3					57						
Jupiter	3	28.73				85				3.55	2-4	In eye
Highway A1A	3					92						
Jupiter Inlet CG	3			ENE 60c		80c						
Stuart	3	28.80	1300			N 69	1100					In eye 1145-1300
Jensen Beach	3	28.70	1300									
Sebring	3									3.38	3	
White City	3	28.69	1417							7.91	3-4	
Fort Pierce CG	3	28.73		NE 70		95		4.0#				
Vero Beach	3	28.36	1400							8.92		In eye
Fort Drum										8.10	3-4	
Kenansville										7.30	3-4	
Melbourne FSS	3	28.68		ENE 31	1550	70	1448					In eye
South Melbourne Beach	3			E 61		86	1600					
Port Canaveral CG	3			NE 60c		80c		4.0#				
Patrick AFB	3			NE 39		hE 68				6.28	3-4	
Kennedy Space Center	3	28.74	2219	E 46	2148	E 77	2113	5.0#		4.67	3-4	
Orlando WSO	3	29.19	2355	NNE 35	1458	N 54	1535					
Herndon Airport	3	29.20	2330	N 28	1553	N 52	1553			3.71	3-4	
Orlando	4					60				3.49	3-4	
Daytona Beach WSO	4	28.98	0208	NE 34	3/1755	NE 55	3/1728	5.3	1710	3.82	3-4	
Beachfront	3					66	3/2000+					
Halifax River	3							3.0#				
Ponce de Leon Inlet CG	3			ENE 40		60		3.0#				
Marineland	4	29.12	0315			67	3/2200			2.60	3-4	
Palm Coast	4	28.97	0354			68	3/1939					
St. Augustine	4	29.10	0300			ENE 48	3/2350			2.43	3-4	
Jacksonville WSO	4	29.20	0640	W 30	1155	NE 46	3/2359			2.91	3-4	
Jacksonville Beach						NE 55	3/2235			1.50	3-4	
Mayport CG		29.66		ENE 30		45		3.4#	3/2200			
Bar Pilot						52						
Fernandina Beach	4	29.13	1000			NW 47	0530					
Georgia												
Brunswick												
St. Simon Island	4			NE 40		45						
Savannah WSO	4	28.65	1755	E 58	1718	E 68	1707			6.86	4-5	In eye
River	4							12.0**				
Tybee Island	4							12.0**				
South Carolina												
Charleston WSO	4	29.36	1910	S 43	2346	SE 56	1830	8.8**		6.76	4-5	
Hilton Head	4					70c						
Columbia WSFO	5	29.26	0330	NE 28	4/1656	NE 43	4/1520			5.26	4-5	
Conway										7.43	4-5	
Eutawville										9.21	4-5	
Dillon										7.65	4-5	
North Carolina												
Brunswick County								3-5#				
Wilmington WSO	5	29.72	0451	S 40	1657	SE 46	0332			7.38		

*Eastern Standard Time
cEstimated
+First of several occurrences
**Above mean low water
#Above normal

Note: Data in table is based on information available and may not represent extreme values which occurred.

Table 7 (con't.).--Meteorological data, hurricane David, August 25 - September 7, 1979

Location	Date	Pressure (inches) Low	Time*	Wind (mph) Fastest Mile	Time*	Peak Gust	Time*	Tide (ft.) Highest MSL	Time*	Rainfall (inches) Storm Total	Dates	Remarks
North Carolina												
Wrightsville Beach	5			SE 44	0325	SE 60	0325					
Lake Waccamaw										8.75	4-5	
Elizabeth Town										7.15	3-4	
Pender County								4.0#				
Jacksonville												
New River	5				0347	SSE 54	0347					
Atlantic Beach	5				1015	SSE 53	1015					
Havelock - Cherry Point	5				1432	S 41	1432					
Pamlico River								2-7#				
Cape Hatteras WSO	6	29.84	0200	SSW 35	0155	S 43	5/1507			10.73	4-6	
Hatteras										6.65	4-6	
Raleigh WSFO	5	29.12	1353	SSE 23	0953	E 36	0743			2.67	5-6	
Elizabeth City FSS										8.52	5-6	
Virginia												
Norfolk WSO	5					41	2250			4.31	5-6	
Richmond WSO	5	29.40		S 30	1900	SE 45	1602			2.71		
Montebello										6.60		
Maryland												
Baltimore (BWI ARPT)	6	29.32	0400	35	1923	52	1918			4.41	5-6	
Fort McHenry	6							4.0#	0100			
Silver Spring										6.89	5-6	
Forestville										7.50	5-6	
Delaware												
Wilmington WSO	6	29.49	0553	37	0128	53	0203	4.0**	5/2000	1.96		
New Jersey												
Atlantic City WSO	6	29.53	0535	SSE 35	0454	SE 51	0508			1.46	5-6	
City Office				SE 32	0400	SE 58	0505			1.83	5-6	
Trenton WSO	6	29.45	0330	SE 30	0500	SE 54	0446					
New York												
Binghampton WSO	6	29.39	0904	24	0445	35	0435			1.87		
Connecticut												
Bridgeport	6					S 69	0913					
Rhode Island												
Quonset Point	6					S 77	1145					
New Hampshire												
Mt. Washington	6					174	1500					

*Eastern Standard Time
cEstimated
+First of several occurrences
**Above mean low water
#Above normal

Note: Data in table is based on information available and may not represent extreme values which occurred.

David was the first hurricane to strike the Cape Canaveral, Fla., area directly since 1926. Cape Canaveral was tied with Mobile, Ala., for having gone the longest of any location south of Cape Hatteras, N.C., without a hurricane. Even though the center of David stayed inland after moving into Georgia, the proximity of the track to the coast produced gale-force winds well out to sea along the Atlantic seaboard and affected a large number of ships.

The death toll in Dominica was 56, and 60,000 of the 80,000 residents were left homeless (fig. 14). In Puerto Rico there were seven deaths. The Dominican Republic government estimated their death toll in excess of 1,200 with damage over $1 billion U.S. dollars. In the United States there were 5 deaths directly attributed to David with about 10 more indirect deaths. Damage in the United States was not great at any particular location, but the cumulative total caused by winds, tides, floods, and tornadoes over the large area affected will likely exceed $300 million (fig. 15).

Additional details on David may be found in the September 1979, November 1979, and January 1980 issues of Mariners Weather Log.

TROPICAL STORM ELENA
AUGUST 29-SEPTEMBER 1

Elena was named a tropical storm at the same time as Frederic, which was the most noteworthy aspect of the storm. A depression formed in the central Gulf of Mexico on August 29 and reached minimal tropical-storm strength about 24 hr later during the afternoon of the 30th. For the fourth time out of the first five named storms, the first advisory on a storm had gale warnings--this time for Port O'Connor, Tex., to Morgan City, La. Little change in strength occurred before landfall on the central Texas coast during the afternoon of September 1, and the storm lost its identity entirely less than 12 hr after landfall.

Maximum sustained winds associated with Elena were 35 kn, and the minimum pressure of 1004 mb occurred during the evening of the 30th. The highest wind reported on land was a 40-kn gust at Galveston, Tex., on the evening of September 1. Highest tides were about 3 ft above mean sea level at Galveston and Baytown, Tex. The only heavy rain of consequence fell on downtown Houston, which recorded 4.6 in, and Beaumont, Tex., which had 3 in. Two persons drowned in Houston from floods caused by the heavy rains, and three crewmen were killed on the CHEVRON HAWAII, when it was struck by lightning and caught fire while thunderstorms associated with Elena were in the vicinity. Except for the ship, damage along the coast was not great.

HURRICANE FREDERIC
AUGUST 29-SEPTEMBER 14

The similarity of the initial development of Frederic to that of David caused much apprehension in the eastern Caribbean Sea area. It appeared that a second Cape Verde hurricane would shortly move through that area even as David was still wreaking havoc. However, the very strength of David caused the weakening of Frederic as the warm outflowing air aloft from David descended onto Frederic and stifled his development. As the weakening Frederic approached, gale warnings were issued for the Leeward Islands, Virgin Islands, Puerto Rico, most of Hispaniola, and the southeast Bahamas, Turks, and Caicos Islands. The main consequence of Frederic in the islands of the eastern Caribbean Sea was heavy rains, especially over the Dominican Republic. However, seven deaths were reported from St. Maarten when a fishing boat sank.

Once Frederic regained strength in the Gulf of Mexico, earlier apprehension during the initial development became well-founded. The presence of David to the east just a week earlier and of Frederic over Cuba left few people unaware of the threat from Frederic. Hurricane warnings went into effect from Grand Isle, La., to Panama City, Fla., at 0230 September 11 with gale warnings east of Panama City to Cedar Key, Fla. It didn't take much urging for people to evacuate early the next day (fig. 16). Of the 41 gale-force observations received at the National Hurricane Center during Frederic, 32 came as the hurricane plowed through the Gulf of Mexico.

Frederic was the first hurricane to strike Mobile, Ala., directly since 1926 (fig. 17). As mentioned previously, Mobile, Ala., and the Cape Canaveral, Fla., area had gone the longest time of any location south of Cape Hatteras without a hurricane. The central pressure of 946 mb and estimated maximum sustained winds of 115 kn at landfall made Frederic the most intense hurricane of this century to affect the Mobile, Ala.-Pascagoula, Miss., area. The highest wind reported in the United States was a gust to 126 kn on Dauphin

Figure 16.--Frederic's well-defined eye is ready to strike Mobile as it approaches the Alabama coastline on September 12.

Table 8.--Meteorological data, hurricane Frederic, August 29 - September 14, 1979

Location	Date	Pressure (inches) Low	Time*	Wind (mph) Fastest Mile	Time*	Peak Gust	Time*	Tide (ft.) Highest MSL	Time*	Rainfall (inches) Storm Total	Dates	Remarks
Lesser Antilles												
Antigua	3					62				12-14	3-5	
St. Barthelmy	3					ED						
St. Maarten	3	29.48	1345			70	1400			12.00	3-5	
St. Kitts	3	29.54	1005			45-50	0945			11.59	3-5	
Saba	3			35	1346	52	1346					
St. Eustatius	3					75	1000			6.92	3-5	
Puerto Rico and U.S. Virgin Islands												
St. Croix										15-24	4-6	
St. Thomas	4			E 29	0800	E 52	0800			10-14	4-6	
St. John										10-14	4-6	
San Juan	4					ENE 38	0200					
Cape San Juan	4			ENE 58	0300							
Gurabo (N.E.)										18.07	4-6	
Cuba												
Guantanomo										>6.88	7-8	
Santa Cruz Del Sur	7			ESW 46	2000							
Bahia Honda	10	29.29	1100	NE 52	0100							
Paso Real De San Diego	10	29.28	0500	S 40	1100							
Pinar Del Rio	10	29.30	0800									
United States												
Florida												
Dry Tortugas	10			E 58	2000+							
Key West	11	29.67	0200	SE 29	10/2300	SE 43	10/1900					
Cape San Blas	12	29.56	1600	ESE 21	1800	ESE 40	1800	4.0f	1800			
Apalachicola WSO	12	29.66	1856	SE 25	1235	SE 35	1235	4.2f	1900			
Panama City CG	12							3.0f	2100			
Eglin AFB	12	29.51	1800	ESE 41	2119	ESE 56	2119			0.95	12	
Hurlburt AFB	12	29.38	1721	ESE 38+	1955	ESE 58	2029			1.38	12	
Destin CG	12	29.47	1745	ESE 55	1915	ESE 63	1900	3.0f	1915			
Pensacola FSS	12	29.18	1845	E 54	1944	E 78	2338			3.28		
Pensacola NAS	12	29.13	1830			E 96	1845					
Santa Rosa CG	12					98c	1800					
Santa Rosa Island	12							10.0				
Perdido Key	12							10.0				
Alabama												
Bay Minette	12									5.59		
Fairhope	12							9.0		4.62		
Gulf Shores	12							12.0				
Gulf State Park	12							9.5				
Fort Morgan	12							11.0				
Bayou La Batre	12							9.0				
Dauphin Island Sea Lab	12	27.84				137f				8.45	12-13	
Dauphin Island Churn	12					ENE145	1939	10.0				
Dauphin Island West End	12							7.5				
Mobile WSO	12	28.38	22.42	E 63	2257	E 97	2207			8.55c	12-13	
Mobile CD	12					101	a2244					
Mobile State Docks	12							8.1				
Mobile 13 N Berry Steam Plant	12							5.5				
Montgomery WSO	13	29.54	0555	E 26	1712	SW 37	1348			0.87	13	
Birmingham FSS	13	29.42	1016	ESE 28	1005	ESE 48	1005			1.49	13	
Birmingham WSFO	13					53	0800+			1.42	13	
Tuscaloosa FSS	13	29.27	0853									
Anniston FSS	13	29.50	1452									
Hamilton	13									5.74	13	
Huntsville WSO	13	29.32	1355	ESE 38	1935	52	1935			2.00	13	
Mississippi												
Pascagoula CD	12	27.94	2250			115	2130f					
Pascagoula Churn	12	28.60	2100			127	2100					In eye 2130-2250
Pascagoula Coop	12									11.00+	12-13	
Pascagoula	12							6.0				
Ocean Springs	12					115c	2300					
Merrill	12									9.00	12-13	
Biloxi CD	12	28.82	2230			NW 98	2359					
Keesler AFB	12	28.62	2230	NNW 61	2129f	NW 98	13/0020f			7.40	12-13	
Gulfport	12					98	2300	3.0				
Bay St. Louis	12	29.10	2230			74						
Pearlington								3.3				
Meridian WSO	13	28.85	0615	N 45	0255+	N 69	0225+			4.46	13	
Meridian NAS	13	28.90	0700	NE 29	0400	NE 50	0400					
Laurel	13					83						
Jackson WSFO	13	29.40	0517	21	0254+	39	0514			1.53		
Columbia	13	29.27				51	0030					
Hattiesburg	13	29.01		70-80c		90c						
Poplarville	13					100f						
Louisiana												
New Orleans WSMO	12	29.47		NW 22	1750	NW 36	2052					
New Orleans FSS	12	29.42		NW 46	2300+	NW 58	2300+					
Slidell WSO	12	29.35										
Grand Isle CG	12	29.49		WNW 17	2100	WNW 32	2100	2.0f				
Boothville	12	29.29		48	1338	58	1419	4.5				
Lake Pontchartrain												
South Shore	12							3.7				
Midlake	12							3.7				
North Shore	12							3.4				
Miss. River Gulf Outlet	12							4.2				
Bogalusa	12									1.38	12	

*Central Standard Time
cEstimated
fAbove Normal
+First of Several Occurrences
$Before Equipment Destroyed

Note: Data in table is based on information available and may not represent extreme values which occurred.

Figure 17.--Pensacola radar shows the eye of Frederic cruising up Mobile Bay early on the 13th.

Figure 18.--Battered hulk driven ashore in Mobile by the mighty winds of Frederic. National Ocean Survey Photo.

Island bridge in Alabama, while a gust to 119 kn was observed at the Dauphin Island Sea Lab before the equipment was destroyed (fig. 18). The peak storm surge of 12 ft over Gulf Shores, Ala., destroyed much of the island. An 11-ft surge at Dauphin Island destroyed the causeway leading to the island. Five deaths have been attributed directly to Frederic. The estimated damage total of $2.3 billion makes Frederic the costliest U.S. hurricane in history.

Additional details on Frederic can be found in the November 1979 and January 1980 issues of Mariners Weather Log.

HURRICANE GLORIA, SEPTEMBER 4-15

Gloria was the first storm of the 1979 season not to affect any land areas. The disturbance which produced Gloria became a depression soon after moving off the northwest coast of Africa on September 4. It passed just north of the Cape Verde Islands, following a northwesterly course instead of the usual westerly course for early September. Satellite pictures indicated that Gloria reached tropical-storm strength on the 6th and hurricane strength early the following day, while about 1,000 mi south-southwest of the Azores. The hurricane moved steadily northwestward at about 10 kn for the next 2 days before turning southwest and weakening briefly to a tropical storm late on the 10th. The weakening and blocking of the hurricane was associated with a higher latitude frontal system and its following high-pressure area. After the HIGH passed to the north, Gloria turned northeastward and accelerated in advance of the next frontal system, losing tropical characteristics about 300 mi northwest of the Azores late on the 14th.

Satellite classifications of strength indicate that Gloria reached maximum intensity of 85 kn on the 13th with an estimated minimum central pressure of 975 mb (fig. 19). Gloria was a threat only to shipping, but there were no reports of damage.

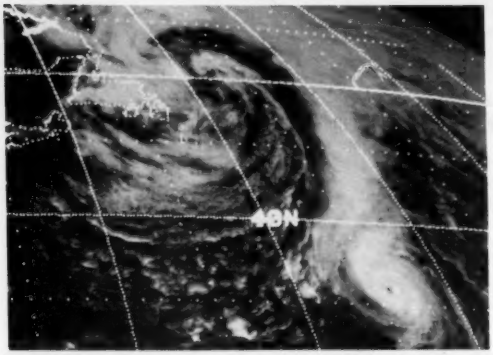

Figure 19.--Hurricane Gloria, near 35°N, 45°W, is on a collision course with a front on the 13th.

HURRICANE HENRI, SEPTEMBER 14-24

While Henri existed as a tropical cyclone for almost 10 days, only 3 of these were as a storm or hurricane. At one time or another during his life, Henri headed in each direction of the compass. In addition, he was the second hurricane of this century to form in the Gulf of Mexico and not make landfall as a storm, further destroying the old saying that a landfall is inevitable once a hurricane is in the Gulf of Mexico. Because Henri remained in the southwest Gulf of Mexico while a storm, few ships were affected.

Late on September 14, reports from NOAA reconnaissance aircraft indicated a depression had formed near Cozumel, Mexico. On the morning of the 15th Air Force reconnaissance located the center north of the northeastern tip of the Yucatan Peninsula. It was moving westward as a large high-pressure system to to north blocked any northward motion. Winds reached tropical-storm strength on the morning of the 16th as the center turned southwestward under the continued blocking influence of the large high-pressure system to the north. Henri became a hurricane early on the 17th as the center turned toward the northwest in response to the weakening ridge of high pressure over the northwest Gulf of Mexico. As a broad area of low pressure developed over the western Gulf of Mexico, Henri's movement became slow and erratic. He reached maximum strength of 75 kn and minimum sea-level pressure of 983 mb in the Bay of Campeche on the 17th (fig. 20), then weakened steadily for the next 48 hr to become a tropical depression on the afternoon of the 19th. The depression moved slowly eastnortheastward for the next 5 days, remaining just south of a cold front which had moved into the northern Gulf of Mexico, and finally became part of the frontal low-pressure trough on the 24th.

Henri threatened the southwest coastline of Mexico in the Bay of Campeche for a time and also hampered efforts to control a runaway oil well in the Bay of Campeche. There have been no reports of casualties or monetary losses caused by Henri.

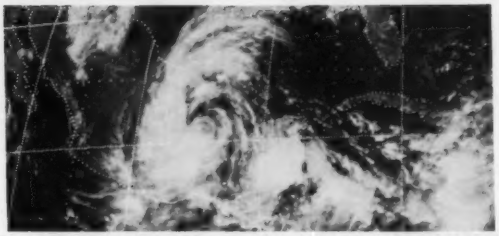

Figure 20.--Henri reaches his maximum strength (75 kn) in the Bay of Campeche.

SUBTROPICAL STORM, OCTOBER 23-25

A low-pressure system which developed on a front south of Bermuda about midday on October 23 strenthened rapidly as it moved north-northeastward and acquired some tropical characteristics. Bermuda reported a minimum pressure of 1002 mb at 2100 on the 23d, and the first visible satellite picture on the morning of the 24th suggested winds had reached 40 kn. The LOW accelerated to a forward speed of 25 kn during the afternoon, while continuing towards the north-northeast, passing through the North Atlantic shipping lanes south of Nova Scotia. The KAPUSKASING, east of the center, reported south-southeasterly winds of 65 kn with seas of 20 ft, and several other ships within 125 mi of the center reported winds of 45 to 50 kn. This was a typical example of the rapidity with which this type of storm can form and move (Hebert, 1973). Sable Island reported a pressure of 984 mb during the evening of the 24th (fig. 21), and the minimum pressure of the storm was estimated to be 980 mb about this time. The storm lost tropical characteristics near Newfoundland. No effects on maritime interests have been received.

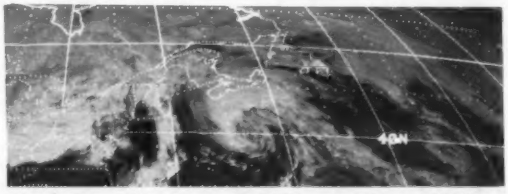

Figure 21.--Shipping south of Nova Scotia was hit by high winds on the 24th by this subtropical storm.

ACKNOWLEDGMENTS

Individual storm accounts include excerpts from reports prepared by fellow hurricane forecasters Gilbert B. Clark, John R. Hope, Miles B. Lawrence, and Joseph M. Pelissier, and the hurricane warning offices at New Orleans, La., and San Juan, Puerto Rico.

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Hebert, P.J., and J.G. Taylor, 1979, "Everything You Always Wanted to Know About Hurricanes--Part I," Weatherwise, 32, pp. 60-67.

Hebert, P.J., and J.G. Taylor, 1979, "Everything You Always Wanted to Know About Hurricanes--Part II," Weatherwise, 32, pp. 100-107.

Mariners Weather Log

GLWMS PLUS SGLMSR FOR LAKES MARINERS

Raymond R. Waldman
Forecast Office
National Weather Service, NOAA
Rosemont, Ill.

The Great Lakes Weather Map Service (GLWMS), a new radio facsimile service, was established for the Great Lakes marine community on December 26, 1977. Since that time marine forecasters at the National Weather Service Forecast Office in Chicago have been transmitting two sets of prognostic weather maps daily to Great Lakes vessels equipped with facsimile receivers.

A map scanner is used to transmit the maps on commercial telephone lines to the Lorain Electronics Corporation at Lorain, Ohio. The signal is taped by the Lorain firm and retransmitted daily to Great Lakes marine interests at 10 a.m. and 10 p.m. e.s.t.

This service is provided free by the Lorain Electronics Corporation in cooperation with the Alden Facsimile Corporation of Westboro, Mass., and the Lake Carriers' Association. Marine forecasters at the National Weather Service Forecast Office in Chicago use the limited area fine-mesh computer model (LEM) provided by the National Meteorological Center (NMC) as guidance in preparing an initial chart and a 24-hr prognostic chart. The set of charts transmitted at 10 a.m.

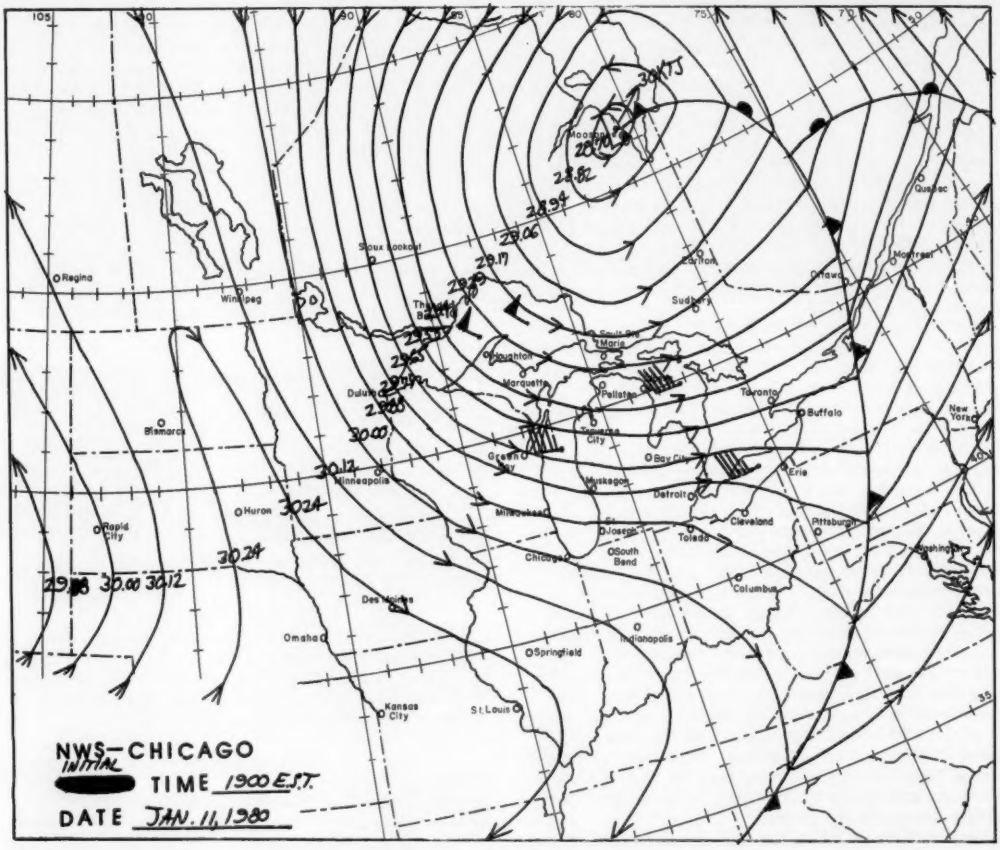


Figure 22.--Synoptic weather chart of 1900 e.s.t. January 11, 1980, which was transmitted by facsimile to Great Lakes shipping.

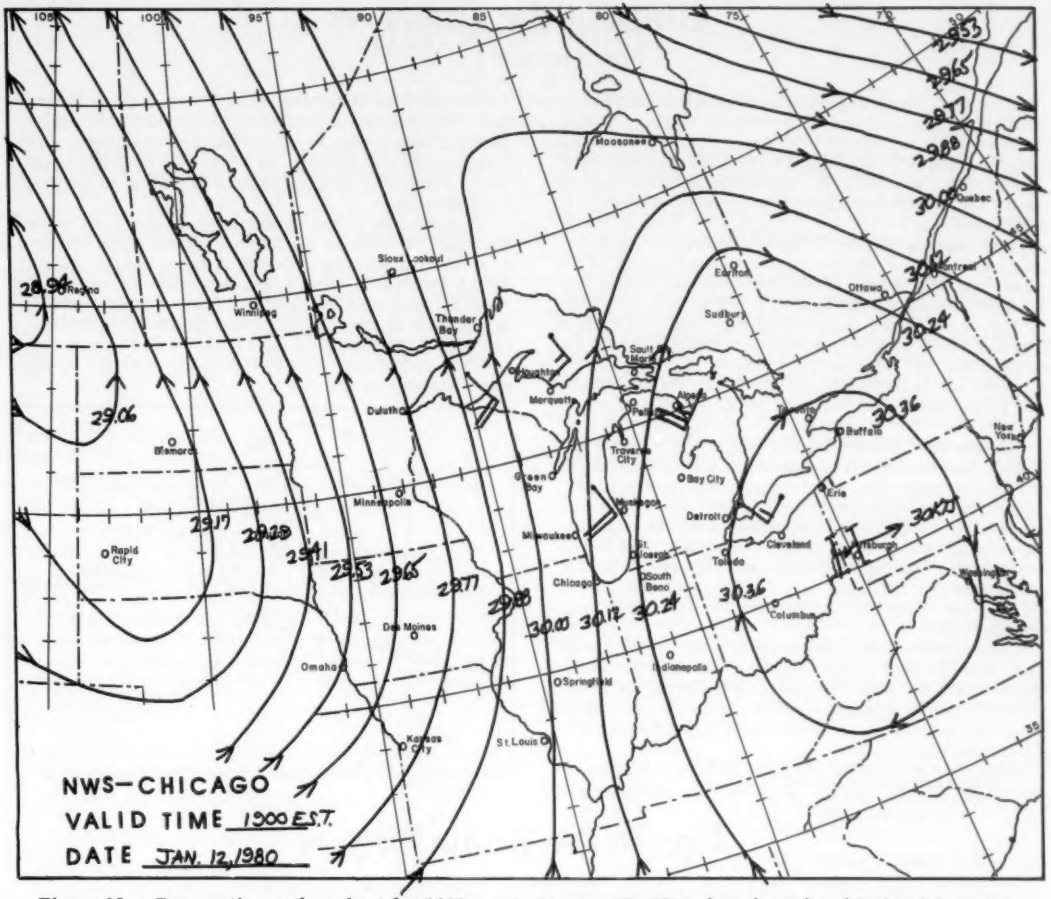


Figure 23.--Prognostic weather chart for 1900 e.s.t. January 12, 1980, broadcast for shipping interests.

e.s.t. by Lorain are valid for 7 a.m. e.s.t. (1200 GMT) that day and the accompanying prognostic chart for 7 a.m. e.s.t. (1200 GMT) the next day. The maps transmitted at 10 p.m. are for 7 p.m. e.s.t. (0000 GMT) and include a prognostic chart verifying for 7 p.m. the following evening.

These charts depict the current and future positions of storm centers and fronts, and wind barbs are added to indicate the observed winds and 24-hr forecast winds for each of the Great Lakes. A typical set of the maps is shown in figures 22 and 23.

Transmission of the map is made via four marine public correspondence channels: channels 84 through 87, with frequencies from 161.825 to 161.975 MHz.

The map service is supplemented by another relatively new marine product--the Special Great Lakes Marine Storm Report (SGLMSR). The storm report is a special bulletin issued only when intense storms bearing winds of 50 kn or more are expected to affect the Great Lakes. When a storm which could pose a threat to marine safety develops, a SGLMSR is issued every 3 hr to describe the location, intensity, and movement of the storm. A summary of the highest winds associated with the storm is included. The Forecast Office at Chicago has the responsibility of issuing this report for all of the Great Lakes.

Both of these new products have been well received by marine interests. At the present time, AMOCO Oil, Inland Steel, Interlake, Huron Cement, and U.S. Steel Great Lakes Fleets have facsimile map receivers on board their vessels. It is hoped that all Great Lakes interests, both commercial and recreational, will avail themselves of this service in the future.

Hints to the Observer

PRECIPITATION TYPES

Recently, there has been increased interest in precipitation types and amounts over the ocean. There is practically no data on amounts over the open water. Ship reports are the basic source for precipitation types. Even with all of the sophisticated remote sensors, the ground truth observation by an observer is still required.

How can you tell the difference between rain and rain showers? In higher latitudes, the location of the observer with respect to the low-pressure center can be a helpful clue to the type of precipitation to expect.

Figure 24 shows an idealized low-pressure system. The system is moving east-northeastward. Warm air to the south and between the fronts is riding up over the cold air in the northeast quadrant, while cold air is pushing under the warm air in the vicinity of the cold front.

An observer some distance east of the warm front would observe advancing cloudiness and weather in the form of cirrostratus, altostratus, and finally light rain. The precipitation generally increases in intensity as the warm front approaches. If the cold air ahead of the warm front is below freezing, rain falling from the overrunning warm air may arrive at the surface as freezing rain or ice pellets or, when the warmer air is also below freezing, precipitation may fall as snow.

Cold fronts move more swiftly than warm fronts. The cold air pushes the warm air up rapidly, and showers are the rule. These showers are usually of short duration and range from light to heavy intensities. They may be rain or snow showers, depending upon the temperatures.

Showers may also be produced without the lifting caused by weather fronts. In warm air, showers may be produced by the overturning of unstable air in warm air masses or when cold air becomes unstable while passing over warm water. This type of shower, called a convective shower, is frequently encountered at sea. These showers would be referred to as air mass-type showers.

In summary, when stratus clouds are present and the rain or snow is continuous without rapid changes in intensity, select a code figure from Aid No. 12 in NOAA Form 72-1 (Ship's Weather Observations) in the 60 to 69 decade of the synoptic code. With cumulus-type clouds in your vicinity, and intermittent rapidly fluctuating precipitation intensities, select a present weather code figure in the 80 decade, or in the 90 decade if thunder is heard.

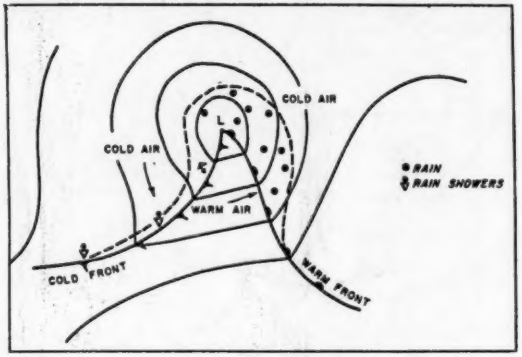


Figure 24.--Rain pattern associated with an ideal cyclone.

Tips to the Radio Officer

Thomas H. Reppert
National Weather Service, NOAA
Silver Spring, Md.

COAST GUARD MARINE INFORMATION BROADCAST CHANGES

Effective March 1, 1980, the scheduled times for Marine Information Broadcasts on VHF-FM were revised as follows:

	MHz	GMT
Charleston, SC (NMB)	157.1	1200, 2200
Mayport, FL (NMA-10)	157.1	1215, 2215
Miami Beach, FL (NCF)	157.1	1230, 2230
Key West, FL (NOK)	157.1	1200, 2200
St. Petersburg, FL (NMA-21)	157.1	1300, 2300
San Juan, PR (NMR)	157.1	1210, 2210

The contents of these broadcasts will remain the same, including weather advisories and forecasts and Broadcast Notices to Mariners.

In Alaska, the Coast Guard is planning to discontinue regular scheduled Marine Information Broadcasts on 2670 kHz effective May 1, 1980. Listeners who may be inconvenienced by this action are requested to address comments to Commander, Seventeenth Coast Guard District (OC), P.O. Box 3-5000, Juneau, AK 99802.

YAKUTAT NOAA WEATHER RADIO OUT OF SERVICE

The National Weather Service's Alaska Region advises that the NOAA Weather Radio Station WXK69 at Yakutat will be out of service until further notice.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JANUARY 1979 EDITION)

Page 12
1-0400 Cullercoats, England GCC
Delete frequency 484; insert 441.

Page 52
2-1170 San Francisco, CA KMI
Add additional times and frequencies:
1300, 1900 4109.5, 8219.8, 12338.1, 12336.2, 16466.2, 22040.3

ACKNOWLEDGMENTS

Thanks to Gerald L. Hale, SS OAKLAND; Lyman G. Hailey, SS WORTH; and A. Hartman, M/V ROYALE EAGLE, for recent information relative to marine weather communications.

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

TROPICAL CYCLONE WATCH - 1980

Table 9 below lists world tropical cyclone activity so far this year. The list is preliminary.

Table 9.--World tropical cyclone watch, 1980

Australia-South Pacific			South Indian		
Peni	TS	Jan.	Hyacinthe	H	Jan.
Paul	TS	Jan.	5-80	TS	Jan.
Amy	H	Jan.	Jacinthe	H	Feb.
Brian	H	Jan.	Kolia	TS	Feb.
Dean	H	Jan.			
Rae	TS	Feb.			
Enid	TS	Feb.			
Fred	H	Feb.			
Simon	H	Feb.			

SOUTH INDIAN OCEAN
NOVEMBER AND DECEMBER

On November 25 a tropical cyclone developed far east of the Diego Garcia Islands (fig. 25). Christened Albine, the west-southwestward-moving system reached tropical-storm strength on the 26th and hurricane strength by the 29th. Hurricane Albine reached peak intensity on December 1 as she began to recurve.

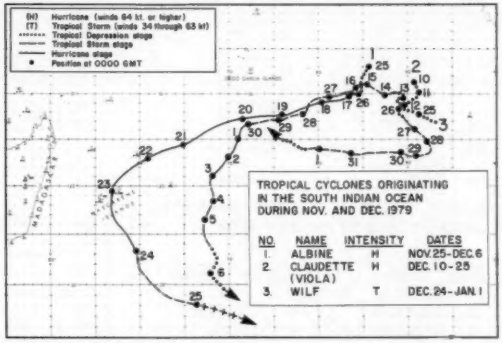


Figure 25.-- South Indian Ocean tropical cyclone tracks, November and December 1979.

Maximum winds climbed to 85 kn with 100-kn gusts near her center. This intensity did not last long, and by the 3d Albine had fallen back to tropical-storm strength. By the 6th the weakening depression moved across the 30th parallel.

Claudette, named Viola by Australia, developed about midway between the Diego Garcia Islands and Sumatra on December 10. Meandering westward, the storm reached hurricane strength a week later some 400 mi from her origin. Now, however, Claudette was on a steady course, and intensification continued. By the 18th winds near her center had climbed to 110 kn with gusts to 135 kn. Gales extended out 300 mi. The following day Claudette reached a peak when her winds were estimated at 115 kn. She moved through the Mascarene Islands, just before Christmas, on the 22d and 23d. On Mauritius 7,000 houses were flattened, sugar cane and other crops were devastated, and an estimated 40 deaths were reported. Gusts of 135 kn were estimated. To compound the problems, huge swarms of bees invaded two damaged sugar warehouses in Port Louis, hindering cleanup and loading operations.

By the 24th Claudette had cleared the islands and dropped to tropical-storm intensity. On Christmas Day she turned extratropical.

Wilf formed on Christmas Eve about 730 mi west-southwest of Christmas Island. He meandered for several days before becoming organized then headed westward. On the 28th and 29th Wilf's winds peaked at about 55 kn with gusts to 75 kn. Gales extended out about 175 mi. However, by the beginning of the New Year Wilf had wilted.

AUSTRALIA-SOUTH PACIFIC
NOVEMBER AND DECEMBER

Only Ofa came to life in these waters during the 2-mo period (fig. 26). She developed between the Fiji and Samoa Islands during the second week in December. On the 11th Ofa brushed Futuna Island and moved through the northern Tonga Islands as a tropical storm. Her maximum winds were estimated at about 45 kn with gales extending out to 80 mi. She maintained this intensity as she brushed Niue in the Cook Islands the following day. Ofa began to fade as she moved south of the other Cook Islands.

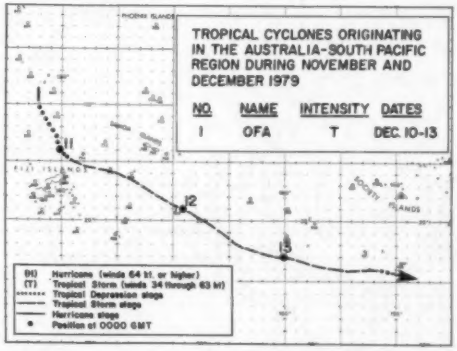


Figure 26.--Australian-South Pacific tropical cyclone tracks, November and December 1979.

NORTH INDIAN OCEAN
NOVEMBER AND DECEMBER

Two tropical storms affected each coast of India during November (fig. 27). The Arabian Sea storm was picked up on the 15th. It was a large system, and gusts to 35 kn were in evidence out to 300 mi from its center. Heading northeastward, the system continued to generate winds of 40 kn close to its center. On the 17th the track shifted northward, and the center missed Bombay by about 80 mi. As it approached the coast, the system weakened, and it was a tropical depression when it crossed the coast of the Saurashtra Peninsula late on the 17th.

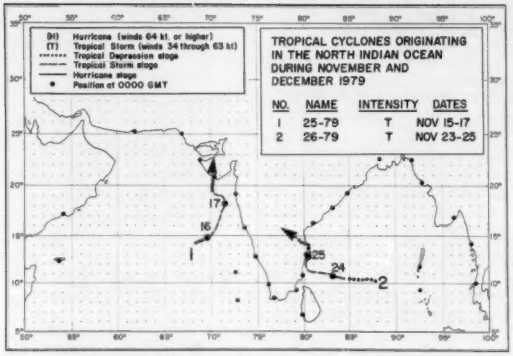


Figure 27.--North Indian Ocean tropical cyclone tracks, November and December 1979.

Less than 1 week later a system developed in the Bay of Bengal. By late on the 23d, it was a tropical storm heading westward. Winds never climbed beyond 35 kn, but showers and thunderstorms did extend to near Berhampur far to the north. The storm skirted the east coast, finally moving ashore near Nellore on the 25th.

GLOBAL TROPICAL CYCLONES JANUARY AND FEBRUARY 1979

This is a first attempt to provide best tracks of tropical cyclones (tropical storms and hurricanes) on a global scale (fig. 28). It would not be possible without the gracious help of many of the world's tropical weather centers. Contributors in the South Pacific region include the Australian Bureau of Meteorology, the Meteorological Department of New Hebrides, the Meteorological Service of New Caledonia, and the New Zealand Meteorological Service. All provided detailed

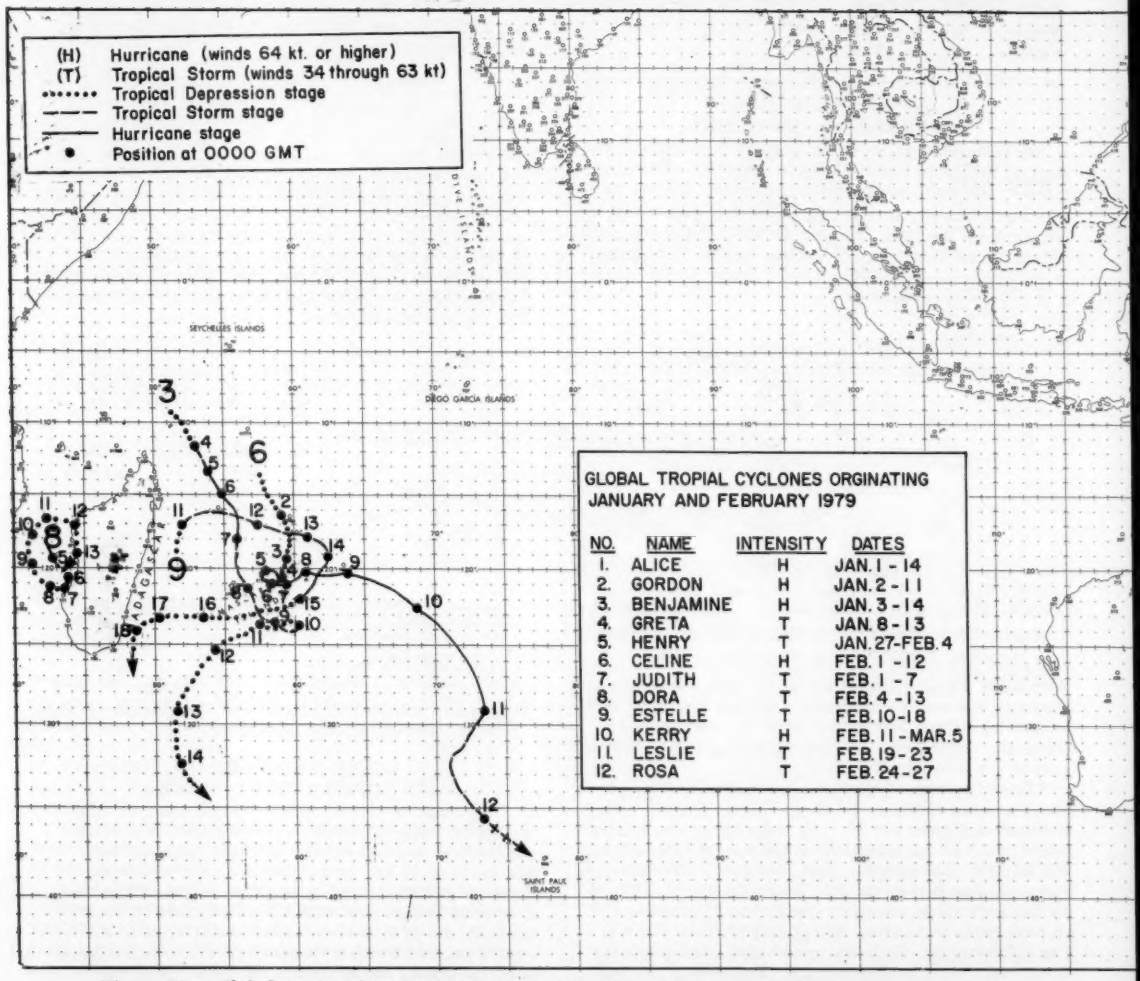


Figure 28.--Global tracks of tropical cyclones originating in January and February 1979.

information. Data for the South Indian Ocean came from the Meteorological Services of Mauritius and Reunion. Both these services turn out interesting and up-to-date annual reports. North Pacific waters are covered by the Joint Typhoon Warning Center in the west and the Central and Eastern Pacific Hurricane Centers in the east. The National Hurricane Center handles the North Atlantic. The National Environmental Satellite Service provides guidance throughout the Tropics. We hope to obtain help from India in the near future.

Since the information that can be displayed on a chart is very limited, we are also going to establish a tape data file at our National Climatic Center. It will include positions at 0000 and 1200 GMT, maximum estimated windspeed, central pressure, and movement.

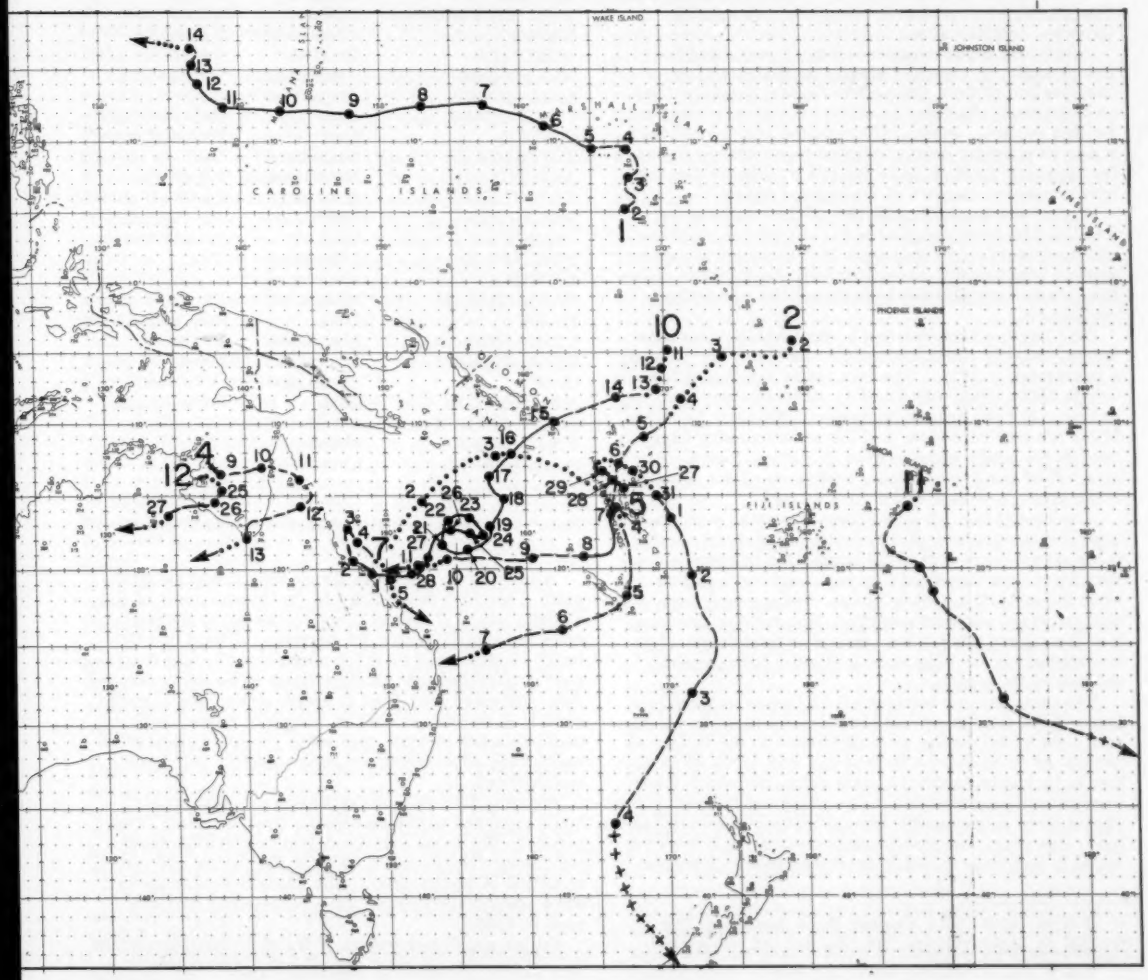
The times on the tracks are 0000 GMT. Positions may represent a composite of several sources. In general we felt the country most affected by the storm will have the more accurate position. Intensities are represented by tropical depression (< 34 kn), tropical storm (34-63 kn), and hurricane or typhoon (≥ 64 kn). If a system did not maintain tropical-storm strength for at least 12 hr, it will not appear.

Table 10.--Global tropical cyclone summary, January-February 1979

No.	Name	Peak Intensity	Estimated max. wind (kn)	Basin	Dates
1.	Alice	H	102	W. North Pacific	Jan. 1-14
2.	Gordon	H	75	Aust.-S. Pacific	Jan. 2-11
3.	Benjamine	H	80	South Indian	Jan. 3-14
4.	Greta	T	35	Aust.-S. Pacific	Jan. 8-13
5.	Henry	T	50	Aust.-S. Pacific	Jan. 27-Feb. 4
6.	Celine	H	95	South Indian	Feb. 1-12
7.	Judith	T	50	Aust.-S. Pacific	Feb. 1-7
8.	Dora	T	35	South Indian	Feb. 4-13
9.	Estelle	T	40	South Indian	Feb. 10-15
10.	Kerry	H	90	Aust.-S. Pacific	Feb. 11-Mar.5
11.	Leslie	T	55	Aust.-S. Pacific	Feb. 20-23
12.	Rosa	T	55	Aust.-S. Pacific	Feb. 24-27

H - hurricane or typhoon
T - tropical storm

During January and February of 1979, 12 tropical



cyclones developed of which 5 attained hurricane or typhoon strength. This compares favorably with the global average of 13 tropical cyclones including 6 hurricanes. Except for typhoon Rose, activity was confined to the Southern Hemisphere. While February was more active, January had the greater number of hurricanes. Table 10 summarizes the activity.

On the Editor's Desk

MORE ON THE FASTNET RACE[1]

A report has been published of an independent study of the Fastnet Race disaster of August 13-14, 1979. The main conclusion is that the blame for the disaster should be placed on the severity of the storm, rather than on any failure of yacht design or the inexperience of some of the crews. But, according to the report, there is a disturbing correlation between certain design characteristics and lack of stability of yachts which should be urgently examined. Most criticism is levelled at the inadequacy of washboards, which should seal companionways, safety harness, and liferafts.

The study made recommendations regarding the use of radio, search and rescue methods, and reexamination of fleet sizes. The Fastnet was described as a supreme challenge to ocean racing yachtsmen in British waters. In the 1979 race the sea showed that it can be a deadly enemy and that those who go to sea for pleasure must do so in the full knowledge that they may encounter dangers of the highest order.

There was implied criticism of the broadcasting of weather forecasts and praise for the rescue services and the unreserved conclusion that the general standards of seamanship, navigation, and certainly of courage, were commendably high among the competing yachtsmen.

The Fastnet Race has had a remarkable record for safety, the only previous accident involving the loss of a yachtsman in 1931. The last really rough weather was in 1957, when only 12 of 41 starters completed the course. But the severe depression of August 14, when 979.2 mb was recorded, and the accompanying hurricane-force winds and 40- to 44-ft waves, took a massive toll of the Fastnet fleet, with most of the yachts being between 60 and 80 mi from land.

The report indicates that three crewmen were lost after the capsize and disintegration of their lifecraft, three others were lost while attempting to board a coaster from their capsized lifecraft, and one was lost when the liferaft in which he was towing emergency gear capsized and broke adrift. Two further crewmen lost their lives after being trapped in the cockpit of an inverted yacht, and six were lost after being washed overboard from yachts.

The common link between all 15 deaths was the violence of the sea, an unremitting danger faced by all who sail. Six of the deaths were attributed to the failure of harnesses or harness attachments, and seven lives were lost in incidents associated with rafts, of which three were directly attributable to the failure of the raft. The yachts were subsequently found afloat and towed to harbor. However, the report points out that 14 lives were saved in incidents in which survivors took to liferafts from yachts which have not been recovered, and many crews successfully used rafts to transfer to helicopters or other vessels. Table 11 lists the fate of various yachts.

Table 11.--Fastnet Race casualties

GOLDEN APPLE OF THE SUN	Abandoned	
CAVALE	Retired	1 lost
FESTINA TERTIA	Retired	1 lost
TROPHY	Abandoned	3 lost
VERONIER	Retired	1 lost
ALLAMANDA	Abandoned	
CAMARGUE	Abandoned	
CHARIOTEER	Lost	Believed sunk
GRIFFIN	Lost	Believed sunk
TIDERACE IV	Abandoned	
ARIADNE	Abandoned	4 lost
FLASHLIGHT	Abandoned	2 lost
POLAR BEAR	Abandoned	
GRINGO	Lost	Believed sunk
HESTRUL II	Abandoned	
LIPSTICK	Abandoned	
CALLIRHOE III	Abandoned	
MAGIC	Lost	Sank under tow
GRIMALKIN	Abandoned	2 lost
GUNSLINGER	Abandoned	1 lost
GAN	Abandoned	
MALIGAWA III	Lost	Believed sunk
BONAVENTURE	Abandoned	
BILLY BONES	Abandoned	
SKIDBLADNER	Abandoned	

Note: All yachts abandoned have since been recovered.

A shortage of distress flares was a serious criticism. Much of the damage to yachts and many of the abandonments stemmed from yachts being knocked down substantially past 90 degrees. A total of 112 boats reported one or more knock-downs, and the report established that smaller boats were more vulnerable. Damage sustained in knock-downs was considered to have been caused by weight of water, rather than pressure of wind, and some reports indicated an inadequacy of securing arrangements for batteries and cookers.

Steering failure most seriously affected larger boats equipped with a particular type of carbon fiber rudder. The most serious defect concerning watertight integrity was found to be in the design and construction of washboards. The study indicates there were similar difficulties with washboards during a race in 1956.

Only a small percentage of the fleet considered that the crews were short of experience, and according to

[1]Edited from "The Fastnet Race Inquiry," The Journal of Meteorology, Vol. 5, No. 45, January 1980, United Kingdom.

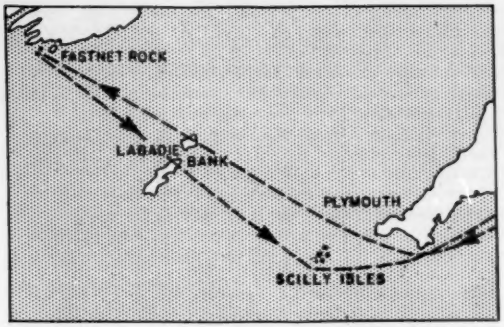


Figure 29.--Track of the Fastnet Race showing Labadie Bank, where extraordinary waves were encountered.

the report, boats skippered by yachtsmen with little long-range experience were not an exceptionally high risk.

Competitors listening only to shipping forecasts received about a 3-hr warning of gale-force winds and no advance warning of winds stronger than gale force. The report points out that the broadcasting of gale warnings by the BBC at times other than for the shipping forecasts was of limited value. The weather conditions during the August race were not unprecedented. Meteorological Office reports show that such depressions occur in August in the South-West Approaches about 1 in 10 yr. The last similar August storm was in 1970. Nevertheless, 58 percent of those questioned said the weather in August 1979 was the worst they had experienced. By the time the race officially ended on the 16th, the toll was: 303 started; 85 finished; 194 retired; 15 crew lost; and 23 yachts abandoned, including 5 lost and believed sunk.

An investigation of the possible role of the Labadie Bank in the Fastnet Race disaster was made by a newspaper. The Labadie Bank is shown as a fish-shaped mark on the chart of Western Approaches, lying slightly to the west of the midway point in the Atlantic between Land's End and Fastnet Rock. A yachtsman plotting his course for the Race would draw a line straight across it to give himself the most direct course to the Irish coast. The depth of water shown is between 200 to 300 ft on the 30-mi length and 10-mi breadth of the bank, enough to give ample clearance to the biggest and most deeply laden cargo ship, let alone the keel of a racing yacht. The approximate position of Labadie Bank is 50.5°N, 8.2°W (fig. 29). More yachts were capsized, knocked flat, dismasted, and damaged in the extraordinary waves above the Labadie Bank than on any other part of the course.

The force 10 gales that swept into the area on the 13th caused a build-up of huge seas on the Continental Shelf, over which the race is sailed. The pressure of these seas on the Labadie Bank, which is 200 ft shallower than the rest of the Shelf, caused viciously confused waves crashing together from different directions. The navigator of one boat which survived a crossing of the bank said: "It was like sailing through the Alps, and the wind was so strong that it was impossible to breath while facing it."

The steep faces of the waves and the short distances between them created awesome conditions. It was the misfortune of the smaller yachts in the Fastnet fleet, boats 36 ft long and under, to be sailing west across the Labadie Bank when the storm was at its worst. The bigger yachts, being faster, had already rounded Fastnet Rock and were past the bank heading southeast for the finishing line at Plymouth.

NOAA SCIENTISTS PREPARE FOR SOLAR MAXIMUM

The Sun is at the peak in its 11-yr cycle of sunspot activity, but the reaction--for Earth--is yet to come.

The forms of solar activity that affect the terrestrial environment tend to reach their peak after the official solar maximum, which is defined in terms of sunspots. Over the coming months, enormous solar flares will touch off magnetic storms and other disturbances on Earth, which could cause occasional disruptions in radio communications and power transmission, computer failures, or even false alarms in civil defense networks.

It will also mean a hectic job for the group charged with providing critical information to explain, correct, or prevent such disruptions: solar forecasters from the Space Environment Services Center in Boulder, Colo., operated jointly by NOAA and the Air Force. They keep constant watch on the Sun and its earthly effects with optical telescopes, satellites, and a worldwide network of ground-based magnetometers. From these data, they make regular reports and forecasts of solar and magnetic activity.

A flare is an eruption of ultra-hot gases from the Sun's surface. High-energy particles rush outward into space, some near the speed of light. The particles set off storms in the Earth's magnetic field, which in turn play havoc with earthly electronics. The particles have more direct effects, too. In polar regions, where the lines of force of the Earth's magnetic field diverge, the particles can penetrate far enough to constitute a radiation hazard for passengers on high-flying aircraft. Forecasts from the NOAA laboratory allow pilots to avoid polar routes when radiation levels might be high.

In recent months solar flares have caused varied problems. The Center has received reports that some transoceanic airliners briefly have lost their high-frequency radio communications; the Coast Guard's ship-to-shore signals have gone out; there have been communication and control problems with satellites. There was one report that flare activity might have set off a civil defense circuit in Canada, throwing radio stations automatically into an alert mode. There is also new evidence that high-energy particles from large solar flares could be responsible for certain computer failures. Such events, and the flares that caused them, happen almost every year, but they are more frequent and more severe during solar maximum. This maximum is turning out to be one of the most spectacular of this century.

Curiously, although the NOAA scientists believe the peak in the solar cycle was in late November or December, they will not know until May or June just when it was. The standard scientific index of solar activity is the sunspot number, a figure that combines number and size of sunspots, averaged over time. Already, this solar cycle--number 21--has proven a near record-breaker. The sunspot number for November is 164.8. In the past century, only one cycle exceeded that number--Cycle 19, which peaked in 1958 with a

sunspot number of 201.

Even if this cycle were not unusually violent, its impact would still be unprecedented. The benefits of advanced technology carry the penalty of increased vulnerability to solar storms. In centuries past, solar tantrums may have reached levels that would make Cycle 21 seem tame. But even if our distant ancestors were aware of such convulsions, they could not have cared much, for the practical effect on them would have been nil. Now, what the Sun does can affect the activities of everyone on Earth.

The effects are not all bad, of course. Between flares, short-wave radio operators should enjoy unusually good reception because the high radiation levels that accompany sunspots strengthen the Earth's ionosphere, so that signals can be bounced easily into the Southern Hemisphere to reach places like Australia or New Zealand. Residents of middle latitudes will also have their best chance in years of viewing the most beautiful side effect of solar activity, the aurora.

The 11-yr solar cycle is irregular but persistent; astronomers have been recording it for 2 centuries. Over this time, the dark blemishes on the solar face have increased and decreased in a regular fashion. The time between solar minima, when sunspots are scarcest, has averaged out to 11 yr. But this is a statistical average. Cycles have lasted anywhere from 10 to 14 yr.

No one knows why, but though solar flares erupt from sunspots, the most frequent and violent flares occur after the peak in sunspots. There is usually a lull in flare activity sometime near the sunspot maximum. True to form, December was relatively quiet, with only small flares and minor magnetic storms.

MISSISSIPPI RIVER TRAFFIC CONTROL

The National Transportation Safety Board has recommended that the Coast Guard establish procedures for control of traffic on the lower Mississippi River when visibility is limited.

The Safety Board called for procedures which would provide coordination between the Coast Guard's Captain of the Port and Vessel Traffic Center (VTC) in New Orleans to control traffic. They also recommended that the Coast Guard accelerate its current plan to begin rulemaking December 1980 that would make participation in the Vessel Traffic Service (VTS), which the VTC provides, mandatory.

The Safety Board made its recommendations in reporting on the head-on collision of two bulk-cargo freighters in dense fog at a sharp turn in the river some 15 mi below New Orleans on November 9, 1978. There were no fatalities or injuries aboard either ship, but total vessel damage was estimated at $4 million, and fuel oil spillage forced closing of the nearby city water intake.

The Safety Board determined that the probable cause of the accident was "the poor judgment of the pilots" of the upbound Panamanian motor vessel MARITIME JUSTICE and the downbound Greek motor vessel IRENE S. LEMOS "when they agreed to meet and pass, in near zero visibility conditions, at English Turn Bend where the risk of collision was much greater than in a straight portion of the river, and the failure of the vessels to move to the extreme right of the channel."

Contributing to the accident, the Board held, was "the failure of the mate on the MARITIME JUSTICE and the master of the IRENE S. LEMOS to exercise their responsibility to assure that the vessels were navigated safely, rather than indiscriminately relying on the pilots of the vessels."

Investigation showed that the pilot of the IRENE S. LEMOS had contacted the pilot of the MARITIME JUSTICE by radio 9 min before the collision, and that they had agreed on a port-to-port passage at English Turn Bend. Each ship observed the other on its radar, and each pilot ordered evasive action before the collision occurred. The IRENE S. LEMOS sounded required fog signals; the MARITIME JUSTICE did not.

The Board believes that "restriction on the continued operation of vessels on difficult portions of the lower Mississippi River under dense fog conditions needs to be examined," and that "one-way traffic patterns in these difficult stretches during conditions of reduced visibility would reduce the risk of collision."

The Board said the VTS needs more accurate information on movements of all vessels on the river by some form of vessel surveillance, and improved Coast Guard procedures are needed "to insure prompt action to control vessel movements" on the lower Mississippi when visibility is limited.

Roughly one-half of the vessels traversing the lower Mississippi River now voluntarily report their positions to the New Orleans VTC, and the Board last October urged the Coast Guard to make VTS participation mandatory at Algiers Point in New Orleans.

The Safety Board also recommended in its report that the Coast Guard (1) determine which lower Mississippi River bends should have one-way traffic during low visibility and require it there; (2) require the New Orleans VTC routinely to provide all participating vessels with important weather information; and (3) reevaluate the proposed lower Mississippi VTS and determine whether an extended surveillance system "is needed to overcome the severe limitations of the present VTS to provide useful, accurate information to participants."

The Board recommended that the Crescent River Pilots Association develop a policy under which member pilots would (1) refrain from meeting or overtaking other vessels in low visibility at difficult locations; (2) confer, well in advance of the maneuver, with ships' masters on any high-risk maneuvering agreements reached by radio; (3) participate in the existing New Orleans VTS "to improve its level of effectiveness and reliability"; and (4) sound required fog signals.

The Board reiterated previous recommendations for masters and pilots to confer in advance about high-risk maneuvers.

The Safety Board's complete printed report may be obtained without charge by writing to the Publications Branch, National Transportation Safety Board, Washington, D.C. 20594. Multiple copies may be purchased by mail from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22151.

SATELLITE SYSTEM TO STUDY OCEANS

NASA's FY-81 budget contains start-up funds for the development of a proposed joint civilian-military ocean monitoring satellite system. The program, called the National Oceanic Satellite System, will be

a joint endeavor of NASA, NOAA, and the Department of Defense. The satellite system will be jointly funded and managed by the three agencies.

The new monitoring system is proposed as a limited operational demonstration of the feasibility of providing from polar-orbiting spacecraft--in near real time and under varying weather conditions--continuous observation of the Earth's ocean surface winds, sea state, surface water temperature, wave height, ice, and other geophysical measurements.

The design duration of the operational demonstration is 5 yr at an estimated cost of $800 million.

Previous research and development spacecraft--NIMBUS, GEOS, and SEASAT--showed that satellite observations of the oceans can play an important role both operationally and as a research tool.

Data from the proposed satellite system, due to its coverage and timeliness, should improve the efficiency, safety, and cost of ship operations, transportation, offshore oil and gas exploration and drilling platform operations, marine construction, commercial fishing, pollution and ice monitoring, and marine search and rescue. Also, it is expected to be especially useful in improving NOAA's global weather forecasting services.

The U.S. Navy expects to use data from the monitoring system for the selection of operating areas, ship routing, strategic operations, antisubmarine warfare, acoustic predictions, tactical ship routing, and global ocean data forecasting.

The proposed system has two major parts, the flight segment and the ground segment. The flight segment will be launched into an intermediate orbit 300 km (186 mi) altitude on the Space Shuttle. The major portion of this segment is an observatory, consisting of a spacecraft "bus" and a specific instrument complement. The spacecraft bus will provide power, attitude control, thermal control, communications, command and data handling, and the necessary propulsion capability to attain mission orbit of 600 to 900 km (373 to 560 mi) altitude and return to the lower Shuttle orbit.

The basic instrument complement for the satellite consists of three previously flown instruments and one now in development. The new instrument is the Large Antenna Multichannel Microwave Radiometer, a much larger version, with a 3.6-m diameter antenna, of the Scanning Multichannel Microwave Radiometer flown on NIMBUS-7. Primary usage of the radiometer is monitoring the sea-surface temperature, windspeed, and sea ice and providing atmospheric corrections for the on-board Altimeter and Scatterometer.

The Altimeter is the same instrument flown on SEASAT, except that two will be flown in the new system for redundancy to meet mission life requirements. It will monitor ocean wave parameters and ocean currents.

The Scatterometer is an upgraded version of the SEASAT Scatterometer System. The new version will have six antennas instead of four and also redundant electronics. It will monitor surface wind velocity over the oceans.

The fourth instrument, the Coastal Zone Color Scanner, is the same as one flown on NIMBUS-7 with three additional channels and will monitor chlorophyll concentration and water turbidity distributions.

The ground segment of the program is a combination of systems which, in conjunction with tracking and data spacecraft and a domestic communications service, will provide on-orbit operation and ground data processing and data distribution for the mission. This segment includes a primary processing facility, observatory and system control facilities, archiving facility, and interfaces with primary NOAA and Department of Defense user facilities.

NEW NORFOLK PMO

The National Weather Service has announced the selection of Mr. Earle Ray Brown as Port Meteorological Officer (PMO) for the Norfolk, Va., area (fig. 30). Mr. Brown replaces William "Bill" Gribble who retired in December 1979 after 36 yr Federal service.

Ray brings with him 28 yr of meteorological experience, including several years with the Atlantic Weather Project. While with the Project, Ray made 50 ocean weather station voyages on various U.S. Coast Guard and MSTS vessels. Most recently, Ray served at the National Weather Service Support Facility in Wallops Island, Va., where he assisted in providing weather support for NASA programs and projects.

Along with assuming the duties of PMO, Ray has also acquired a new office. The new Norfolk PMO office address is:

Port Meteorological Officer
National Weather Service, NOAA
Norfolk International Airport
Norfolk, VA 23518
(Commercial telephone: 804-441-6326)

The Norfolk PMO will continue to render all services and supplies requested by marine interests, while maintaining quality checks on shipboard meteorological instruments supplied by the National Weather Service.

We all wish Ray many years of clear skies and calm seas in his new position.

Figure 30.--Ray Brown, the new Port Meteorological Officer at Norfolk, is ready to serve cooperating ships in the area.

WORLD TONNAGE LOST SOARS IN 1979

While the volume of merchant tonnage lost worldwide has risen every year in the past decade, 1979

has set itself apart with a huge increase in the lost tonnage to record levels. Figures released by the Liverpool Underwriters' Association show that it was a particularly bad year for losses for Greece and the flag-of-convenience nations.

The number of vessels over 500 tons lost in 1979 rose by 19 over the previous year to 279. However, in tonnage terms these vessels totaled 2.25 million gross tons--64.2 percent more than the previous record of 1.4 million set in 1978.

A striking feature is that a very large proportion of the world losses are accounted for by ships flying just four flags. Although ships flying flags of Cyprus, Greece, Liberia, and Panama represent about a third of the total merchant tonnage, these flags accounted for about 59 percent of all losses by number of ships and over 74 percent by tonnage.

Liberian-flag vessels accounted for the majority of the increase in gross tonnage lost, with the 15 Liberian-registered vessels lost totaling 782,000 gross tons. This year started badly for Liberian ships with the loss on January 17 of the 96,000-ton tanker SALEM.

The Underwriters' Association claimed that so far as tankers and bulk and combination carriers are concerned (representing 65 percent of the total tonnage lost in 1979), the losses were not old vessels with low values, but mainly vessels under 14 yr old, with the largest increase in 5- to 9-yr-old vessels.

The appalling casualty experience encountered during 1979 will contribute to a considerable hardening in total loss rates by the end of the year. The new joint hull understanding reached near the end of last year has helped underwriters to achieve higher rates, although it seems unlikely that these will be sufficient to offset the adverse casualty experience and to pay rapidly rising repair costs.

ALVIN MAKES 1,000TH DIVE

The Deep Submergence Research Vehicle ALVIN, operated by the Woods Hole Oceanographic Institution (WHOI), made her 1,000th dive on January 15--the 50th anniversary of the Institution. The three-person ALVIN is a national research facility supported by the National Science Foundation, the Office of Naval Research, and NOAA. The sub's depth capability is 4,000 m (13,124 ft).

Chief Pilot Ralph Hollis, NOAA geologist Alexander Malahoff, and George Broderson, crew chief and 16-yr veteran in the sub's working group, participated in the dive. This was one of several dives for Dr. Malahoff's studies of volcanic processes at the intersection of the Ecuador Rift and two fracture zones, undersea mountain structures just north of the Equator in the Pacific Ocean. The work also includes examination of the origin and growth of several seamounts on the south flank of the Carnegie Ridge and erosional processes around the seamounts.

ALVIN, the nation's first research submersible, was constructed in 1964 under a U.S. Navy contract. Its usefulness for work on the sea floor was proven early, when ALVIN joined the search for and eventually located a hydrogen bomb lost in the Mediterranean off Spain following a 1966 plane collision.

Since that time, as pilots have become increasingly skilled at maneuvering the sub and a corps of experienced scientific users has assembled, the ratio of testing to working dives has moved heavily toward the scientific. ALVIN began as an engineering dream with great potential and has become an important oceanographic tool much in demand.

Major users of ALVIN are biologists and geologists whose fields require considerable direct observation. Increasing sophistication of sampling devices has brought chemists into the user fold, and physicists have made current and other measurements using the sub. Work with ALVIN has uncovered important new information on ocean bottom sedimentation and sediment movement and erosion, deep sea microbiology, communities of animals that live in the sediments, and distribution of animals in the water column. Long-term programs based on submersible work have included microbiological and sediment colonization research at bottom stations established at 1,830 and 3,660 m (6,000 and 12,000 ft) and a series of expeditions beginning in 1974 aimed at better understanding of the theory of plate tectonics, the idea that the surface of the Earth is composed of huge crustal plates that are in constant very slow motion. A recent expedition to the Galapagos Rift was featured in the November 1979 National Geographic magazine and in a January 8 National Geographic Society television special.

With the initial steel personnel sphere, ALVIN could dive to 1,830 m (6,000 ft). A titanium sphere installed in 1973 doubled the depth capability. ALVIN's early years were funded by the U.S. Navy, which owns the sub and sometimes employs ALVIN for inspection of underwater structures. Beginning in 1974, the National Science Foundation and NOAA agreed to share the funding with the Navy. The 1979 operating budget for ALVIN was $1,829,000.

ALVIN is an elision of the two parts of Woods Hole oceanographer Allyn Vine's name. Well known as an innovative engineer, Vine is credited with firing the enthusiasm of Navy powers for building the sub and with participation in the craft's design. The sub's mothership, LULU, a 105-ft pontoon vessel, is named for Vine's mother.

The 25-member ALVIN support group at WHOI is headed by John D. Donnelly, who joined the ALVIN group in 1971 following retirement from the Navy, served as chief pilot for several years, and became head of the group in 1978.

WHOI is a nonprofit research and advanced educational facility in Cape Cod, Mass. Its resident staff of nearly 1,000 scientists, technicians, and support personnel are engaged in oceanographic research embracing the basic disciplines of biology, chemistry, geology, and physics as well as ocean engineering. The Institution operates three large research vessels and a coastal research boat in addition to ALVIN and LULU. WHOI was founded following the recommendation of a National Academy of Sciences Committee that an American oceanographic facility be located on the East Coast.

SPECIAL WEATHER STATEMENT - NATIONAL WEATHER SERVICE, ANN ARBOR, MICH.

The five Great Lakes, up to mid-January, had very little ice on them. Most of the ice is confined to the bays and harbors. One measure of how much ice can be expected is called the freezing degree day (FDD).

An FDD is defined as the difference between the daily mean temperature and 32°; therefore, if the daily mean is 31, you accumulate 1 FDD. These FDDs are accumulated for various stations around the Lakes. By watching the accumulations of FDDs, the NWS can get an idea of how much ice is accumulating.

The following is a comparison of FDD accumulations through mid-January of this year and the 3 previous years for six stations around the Great Lakes.

Station	1977	1978	1979	1980	Normal
Duluth, Minn.	1726	1251	1570	687	995
Sault Ste. Marie, Mich.	1262	786	1006	503	652
Alpena, Mich.	928	695	695	302	398
Milwaukee, Wis.	959	626	747	155	355
Cleveland, Ohio	585	249	253	76	104
Rochester, N.Y.	496	241	316	141	192

As can be seen this winter is milder than normal and much warmer than the three previous winters. To find a previous winter with similar ice conditions and FDD accumulations one has to go back to 1975 and prior to 1975 one must go back to 1955 to find a similar winter. The winter of 1979-80 (through mid-January) is one of the three mildest of the past 25 yr.

The following table shows the ranking of this winter (through mid-January) and the three previous winters over the last 80 yr where 1 is the coldest and 80 is the warmest for the same six stations.

Station	1977	1978	1979	1980
Duluth, Minn.	1	17	3	74
Sault Ste. Marie, Mich.	1	23	5	69
Alpena, Mich.	1	5	5	64
Milwaukee, Wis.	1	10	4	77
Cleveland, Ohio	1	22	22	55
Rochester, N.Y.	5	36	24	61

Some of the above statistics were compiled by the Great Lakes Environmental Research Laboratory in Ann Arbor, Mich.

GREAT LAKES-SEAWAY OPEN

The St. Lawrence Seaway, Welland Canal, and Soo Locks opened on March 24--the earliest opening on record.

The earliest previous opening date after the winter freezeup was on March 25 in 1975, according to a joint statement by the St. Lawrence Seaway Authority and the U.S. St. Lawrence Seaway Development Corporation.

The early opening will allow a prompt start on moving a backlog of grain at ports in the western Great Lakes. Farm groups have been calling for the Seaway to open as early as possible so that more grain can be exported.

UNDERSEA TRAFFIC JAMS NOT LIKELY SOON

Crabs aren't the only things crawling along the ocean floor these days. They are being joined, increasingly, by pilotless research and work vehicles (fig. 31) considered safer and less costly than manned undersea craft.

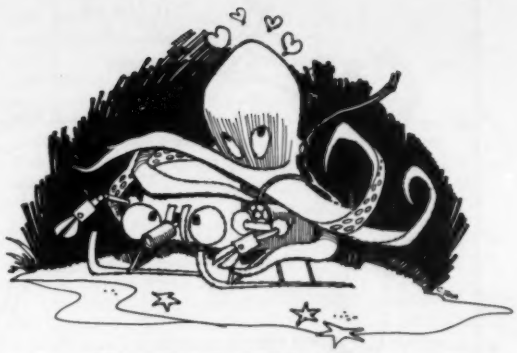


Figure 31.--An ROV in action.

While the number of remotely operated vehicles (ROVs) in use today hardly creates a traffic problem for scuba divers, submarines, and other undersea traffic, it has increased 1,000 percent in the last 5 yr, according to a NOAA report.

Today about 180 ROVs are in use or being built around the world, mainly for the oil and gas industry. An additional 120, not covered in the NOAA survey, are being used by various navies to neutralize explosive mines. Other main users of the small underwater units that crawl, "swim" or are towed include the military and the scientific research community.

The vehicles are used industrially for inspection of underwater structures, monitoring of beneath-the-surface activities, assisting divers, bulldozing and trenching the ocean floor, and a variety of other purposes. Some research ROVs are capable of fine-grained mapping, water sampling, and radiation measurements; while others have been used for under-ice profiling, wake turbulance measurements, and profiling of conductivity, temperature, and pressure.

The governments of several nations, as well as private industry, are sponsoring research and development into additional uses of ROVs. Major U.S. supporters include NOAA's Office of Ocean Engineering, the U.S. Navy, and NASA. The University of New Hampshire, Massachusetts Institute of Technology, and the University of Georgia all are pioneering in the development and uses of ROVs.

NOAA's survey is entitled "Remotely Operated Vehicles." It describes in detail the construction, characteristics, and uses of ROVs throughout the world, as well as problems encountered by the various types, and recommended areas of research and development. Specifications and photographs of nearly 100 ROVs are included. Copies may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for $7.50 each.

YACHTS RACE TO BEAT THE CLIPPERS

The tea clippers of the last century were involved in great competition to make the fastest journeys from the Orient to Europe so that their cargoes would be the first on each season's market.

Many fine boats were built in the era and some remarkably quick passages were made. Now, in 1980, an attempt is to be made to beat the records set by

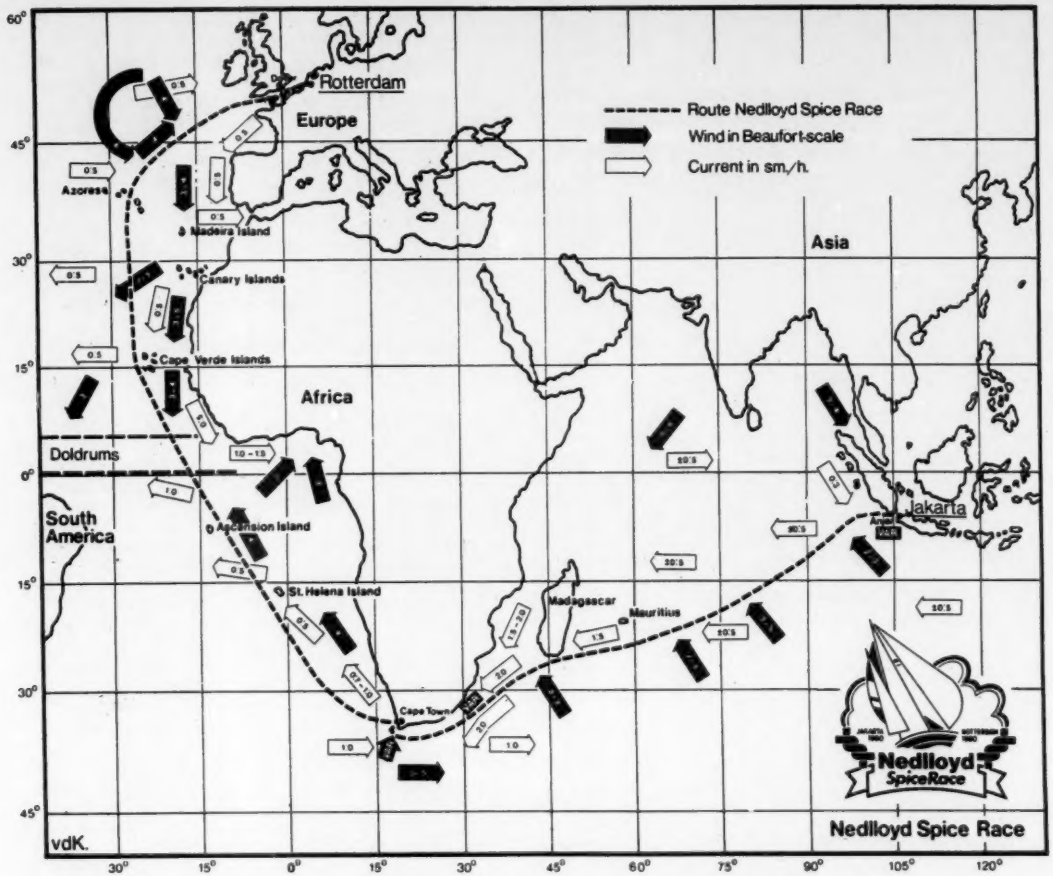


Figure 32.--Track of the 1980 Jakarta to Rotterdam spice race.

the fastest and the greatest of these sailing ships such as the CUTTY SARK (perhaps the most famous tea clipper) and the lesser-known KELSO, which made some very fast passages, particularly from Java to Europe.

The new spice race will start in Jakarta. From Jakarta, the spice race yachts will sail to the Cape of Good Hope for a brief stopover, and then on to the finish of the 12,000-mi race in Rotterdam (fig. 32).

The KELSO was an early ship of the tea clipper era, built in 1855 in the north of England. Her fastest passage from Anjer to the English Channel was 63 days, which she achieved on her last journey in 1860-61. The KELSO left Macao on September 19, 1860, and passed Anjer on October 30.

On November 21 she rounded the Cape of Good Hope, 23 days out from Anjer, near Jakarta, and reached St. Helena on November 21, 30 days out. According to the London and China Express of January 10, 1861, she arrived at the south coast of England on January 1, 1861, having made the passage from Anjer in only 63 days, the fastest recorded clipper journey between the two points.

However, it was the last voyage the KELSO ever made, for she ran aground off the English coast just 1 mo later.

The CUTTY SARK's fastest run between Anjer and the English Channel was 71 days on her maiden voyage in the tea race of 1870. This was a time when competition among the tea clippers was at its height and the CUTTY SARK was one of the fastest ships of her time. She was built in 1869 in Scotland specially for the tea trade.

On June 25, 1870, she left Shanghai, passed Anjer on August 2, and reached the Cape on August 28, 26 days out from Anjer, having passed Mauritius on the 14th day. She continued to St. Helena, Ascension Island, across the Equator, past Cape Verde and the Azores, arriving at Beachy Head on the night of October 12, 71 days after she passed Anjer.

The CUTTY SARK was only beginning many years of outstanding service in the tea and wool trades.

A Dutch ship, the NOACH I, made a very fast run from Anjer to the English Channel in 1863, too. She sailed from Jakarta on September 10, arriving in the English Channel 65-1/2 days later, and in Brouwer-

shaven in Holland on the 71st day. This was a record for a Dutch ship and a very fast run indeed for any sailing ship between these points.

Now, in 1980, sailing ships from all over the world will compete with each other in an attempt to beat the records of the KELSO and the CUTTY SARK and be the first to arrive in Rotterdam.

Behind these boats this year there will not only be the determination of the captains to win, but also the extra incentive to break these longstanding sailing records. The race leaves Jakarta on March 12. It should finish in Rotterdam between mid-May and mid-June.

CLIMATIC CHANGES MAY BE RELATED TO VARIATIONS IN SOLAR LUMINOSITY

Some scientists believe that climatic changes are the result of variations in the amount of energy leaving the Sun's surface--solar luminosity--and reaching the Earth. Because no method has yet been devised that is sensitive enough to measure accurately and definitively possible variations in the solar "constant," the radiant output of the Sun has generally been assumed to be uniform. However, if solar convective flux, as evidenced by variations in sunspot activity, is a measure of solar luminosity, and if variations in the structure of sunspots indicate such variations in convective flux, there is a readily available method for measuring temperature differences imbedded in the solar constant.

A NOAA scientist has related the ratios of the areas of sunspot umbras (dark centers of sunspots) to penumbras (gray areas surrounding the centers) to a plot of the normal annual surface temperature of the Northern Hemisphere. Working in NOAA's Air Resources Laboratories in Boulder, Colo., he found a high correlation between the two over the long period of record. The ratio varies with changes in the Earth's climate so closely that it would appear a large portion of climatic change is caused by fluctuations in the solar luminosity, or so-called solar constant. Variations and trends established by these highly correlated factors may prove to be important in forecasting climatic changes, and more especially, droughts.

The umbras and the penumbras of sunspots have rather distinct boundaries and can easily be distinguished one from the other, and from the Sun's surrounding, quiet photosphere. Their areas have been accurately measured and recorded for the past 100 yr, and the ratio of the areas of umbras to penumbras can be computed so that a single number provides a measure of sunspot structure on an annual basis. The ratio varies between 0.15 and 0.27 with a few exceptions. A plot of the annual ratios (1874-1970) shows that the variations are not random, but follow long-term secular trends. Superimposed on the long-term trends is a cycle of about 20 yr, and a possible much weaker cycle of about 11 yr. The umbral-penumbral ratio is the only known solar feature other than the Sun's general magnetic field with a cycle approaching in character the 22-yr double sunspot cycle.

When plotted with the curve of the Northern Hemisphere surface mean annual temperatures, the variations with umbral-penumbral ratios are notably alike. Also, in general, the colder years are associated with lower values of the umbral-penumbral ratios (smaller solar constant). The cross-correlation of the two curves is 0.57, which is statistically highly significant. The umbral-penumbral ratio may be a measure of the convective energy transport in the Sun's photosphere and an index of a global property of the Sun which is proportional to the solar luminosity. The variations in sunspot structure also parallel variations in solar rotation. Before about 1930 the solar rotation was decreasing to a minimum; from 1930 to present, the solar rotation has been increasing. It appears that energy which goes into or out of the rotational energy reservoir results in a decrease or increase respectively in solar luminosity.

The maximum values of the umbral-penumbral ratios coincide rather closely with the years of observed droughts in the western United States and may prove to be a valuable forecast tool. On the basis of this relationship, the larger the solar constant the greater the probability of a drought; there is no case when a drought occurred that was not successfully predicted. Remeasurement of available records of umbral-penumbral areas using more accurate techniques, and continued monitoring of the sunspot areas would help in determining if the ratio again peaks before the next western U.S. drought.

EARTHQUAKE OFF ECUADOR-COLOMBIA PACIFIC COAST

More than 300 people were killed, hundreds injured, and 200,000 left homeless when a strong earthquake struck western Colombia on December 12, 1979. The undersea quake virtually destroyed the small fishing town of La Charca and seriously damaged 25 other communities. Rubble and massive relief operations are underway. Thirty fishermen disappeared at sea off the Colombian coast when the quake, which registered between 7.7 and 8.1 on the Richter seismological scale, set off big waves. Thirty more were missing in the Guapi River. The quake occurred at 0300 hr beneath the Pacific Ocean. Remote western coastal regions of Colombia were the worst affected, although the quake was felt throughout the country and in neighboring Ecuador. Officials said 56 bodies had been dug out of rubble in La Charca and at least 300 of the town's 4,000 inhabitants were injured. In Tumaco 21 people were reported killed and 200 injured. Fifteen additional bodies were found on the small island of San Juan, just off the coast north of Tumaco, which apparently bore the full force of the earthquake. Reports from trawlers reaching the mainland from San Juan said the island's toll could not go much higher. Nearly all the homes on the low-lying island were destroyed by the earthquake's force and surging seas. Rescue operations were hampered because the region has poor communications. Most of the roads in the area were cut by the quake. Some communities are accessible only by rivercraft or helicopter, even in normal times.

The earth movement was described as prolonged and rocking. The astronomical observatory in Quito said the epicenter was in the Pacific Ocean off the Ecuador-Colombia border. Later information indicates that Colombia's port of Tumaco sustained damage to port facilities, and a dozen buildings collapsed in the business district. El Charco, a town of wooden buildings near the coast, was 70 percent destroyed. Fire spread through the ruined buildings shortly after

the quake, and authorities fear that additional victims may have been carried away by the river into the Pacific. The city of Popayan felt the quake strongly, and damage was reported in Pasto and the small localities of Mosquera, Santa Barbara, and Guapi. Docks were smashed at the penal colony on Gorgona Island off the coast, and the port of Buenaventura was also damaged. Radio reports from the zone said a surge of water in the Guapi River washed out homes at El Charco and left bodies buried under a mass of mud. The river apparently rose when water backed up from the ocean a few miles away.

MESOSCALE SEA-SURFACE TEMPERATURE ANALYSIS FOR ALASKA WATERS

In July 1979 the National Environmental Satellite Service's Anchorage Satellite Field Services Station began a program of detailed sea-surface temperature (SST) analysis from satellite data (fig. 33). A program of data enlargements and enhancements tailored to expected seasonal conditions has been designed. During the winter months, ice conditions are included as appropriate. This SST analysis is a composite of data obtained during the preceding week. It is issued on Thursdays and sent out on the Alaskan NWS facsimile network. The areas covered in each analysis are dependent on cloud cover. Usually, some open-water areas are available during this time. Temperatures are not corrected for atmospheric attenuation, but comparisons with ship reports indicate that the values are within $\pm$ 2°C.

CORRECTION

TROPICAL STORMS MAC AND NANCY AND TYPHOON HOPE

The article on tropical storms Mac and Nancy on page 12 of the January 1980 issue of the Log was erroneously attributed to Elizabeth Lo. The article was a reprint of a routine provisional tropical cyclone report from the Royal Observatory, Hong Kong, forwarded to us by Mrs. Lo.

On page 8 of the same issue, the temporary dimunition of the windspeed in typhoon Hope (shown in fig. 6) was attributed to the wind having turned to put the anemometer downwind of an offshore island. Subsequent investigations show that a more probable explanation of the reduction in speed is that the station was just inside the ring of maximum winds at that time.

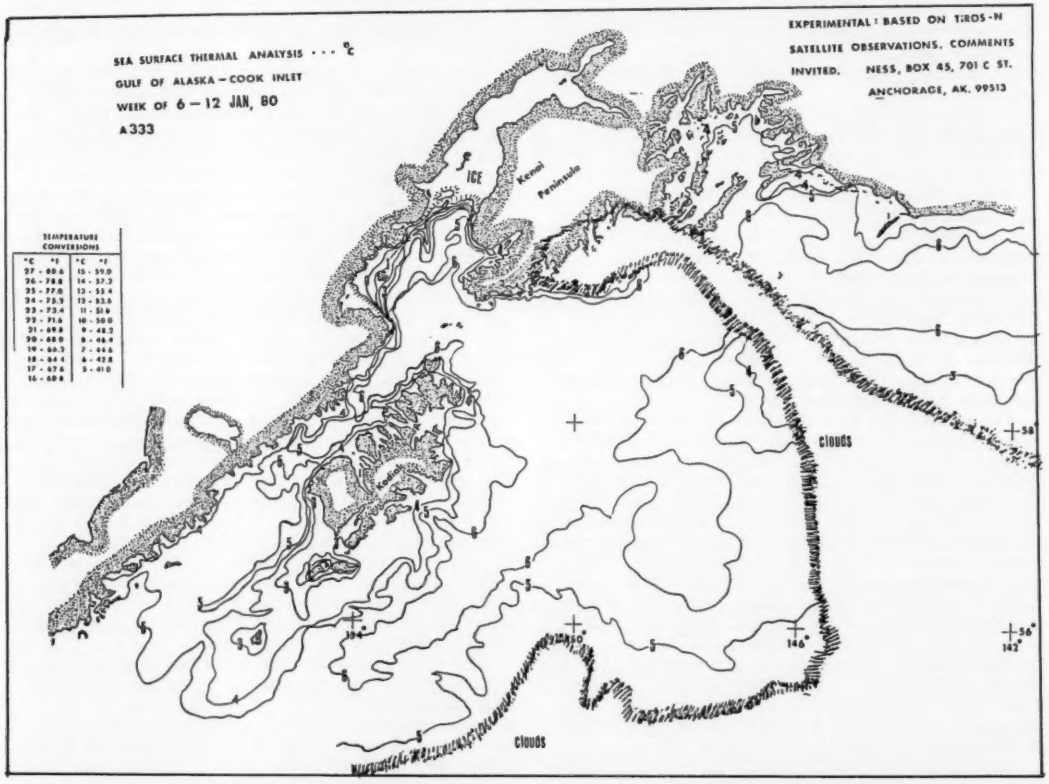


Figure 33.--Sea-surface temperature and ice analysis for week of January 6-12, 1980.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

September and October 1979

SMOOTH LOG, SEPTEMBER 1979--The storm tracks this month between the Canadian Maritime Provinces and the Norwegian Sea closely followed the climatological mean for that area. Storms from the U.S. East Coast did not materialize as climatology indicates. The storms that crossed Canada and thence into Baffin Bay formed farther north and west than usual.

If one compared this month's mean sea-level pressure pattern to the climatic normal without any isobars labeled, they would be very similar (fig. 34). With the addition of specific pressures, the differences show up especially north of 40°N. The primary Icelandic Low center is shifted from midway between Kap Farvel and Iceland to west of Nordkapp, Norway. There were five subcenters from Hudson Strait to Nordkapp ranging from 1001 mb to 1005 mb. The Azores High was shifted about 800 mi northeastward to near 40°N, 20°W, and was 2 mb higher at 1023 mb. There was an anomalous 1008-mb LOW over the Yucatan Peninsula.

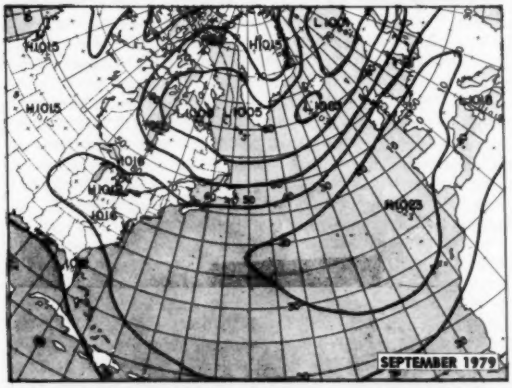


Figure 34.--September 1979 mean pressure chart.

The largest anomaly south of latitude 40°N was minus 3 over the Gulf of Mexico and probably a reflection of tropical cyclones. A plus 7-mb anomaly was centered near Brest, France. On the negative side, there were two main centers, a 4 mb near Cape Wolstenholme and a 7 mb over Lapland.

The height of the 700-mb surface, centered over latitude 30°N, was normal with climatology. The large difference with climatology were the LOWs. Usually there is one centered near the North Pole. This month there was one near Cape Dorset and another near Jan Mayen Island. This resulted in a sharper trough over eastern North America and stronger zonal flow across the water.

Three tropical depressions formed in September, and two became hurricanes Gloria and Henri. David and Frederic formed in August, but they struck the United States in September. The annual article describing the tropical cyclones of 1979 appears on page 88.

Extratropical Cyclones--The headline makers this month were the two hurricanes that struck the West Indies and the United States. Both originated in August, but they will probably be remembered as September storms as that was when their major devastation occurred. The first half of the month the Azores High was weak and generally broken up into multiple cells. This allowed LOWs to penetrate farther south. The last part of the month the High intensified and storms were generally diverted farther north.

The first storm of significance was off Hamilton Inlet on the 1st. The SEDCO 709 near 63°N, 59°W, reported 40-kn easterly winds with 25-ft waves. The NORTHERNSHELL was closer to the coast of Labrador with 40-kn northwesterly winds. On the 2d the SELFOSS at 56°N, 45°W, was north of the storm with 44-kn winds. The storm had been moving southeastward and at 1200 on the 3d was near 51°N, 40°W. Several ships reported gales and waves to 16 ft. On the 4th the storm turned northeastward. The SEA-LAND ECONOMY on the southern edge of the storm radioed 51-kn winds. The DISCOVERY was east of the front and west of Lands End on the 5th with 45-kn winds and 14-ft waves.

The 986-mb storm was traveling northward over Iceland on the 6th. A station on the northwest peninsula measured 50-kn winds from the north-northeast at both 0000 and 1200 synoptic times. The WESTWIND was reporting off the northeastern coast of Greenland. The storm disappeared over the Greenland Sea on the 10th.

Extratropical David--By 1200 on the 7th David was over the Gulf of St. Lawrence and a 980-mb extratropical storm. The FREDERICK CARTER was in Cabot Strait with 55-kn winds. On the 8th the CAPE ROGER was caught off Belle Isle with 40-kn winds and

20-ft seas. At 1200 on the 8th the 988-mb storm was south of Kap Farvel and the C.P. DISCOVERER was south of the center with 26-ft swells. The ECKERT OLDENDORFF found 40-kn winds and 20-ft waves on the 9th. At 1200 it was over Iceland bringing gales to the area. The storm continued to kick up gales as it continued over the Greenland Sea to dissipate off northern Norway.

There was a series of frontal waves on the front out of extratropical David as the front stretched southwestward off the North American coast parallel to the upper air flow. By midday on the 11th the wave had deepened into a 1006-mb closed circulation. The center passed within a few miles of OWS Lima, which registered 999 mb and winds of 35 kn on the 12th at 0600. The ATLANTIC PROJECT and the DAKE were near the same position south of the center at 1200. They registered 989 mb on the barometer with the former having 52-kn winds and 20-ft seas, while the latter had 40 kn and 26 ft.

On the 13th tens of ships on the North Sea were reporting winds of gale force or better. Some had winds over 50 kn and waves up to 30 ft. The 75-ft fishing vessel CALEDONIA sank off Peterhead in northwesterly force 9 to 10 winds and very rough seas. An oil rig tender rescued the crew. On the 14th the storm was over Finland and the cyclonic circulation still reached the North Sea, but the winds there had decreased considerably. Not so over the Baltic Sea. The 496-ton ANNIKA M. listed at 45 degrees in force 8 winds, and her cargo shifted. The crew abandoned ship and were rescued. The tug AXEL towed the vessel [illegible] altered waters.

This storm came out of the Northwest Territories of Canada and was over the Gulf of St. Lawrence on the 11th. SEDCO 707 near 51°N, 51°W, measured 44-kn winds on the 12th. On the 13th the SIR ROBERT BOND (50°N, 55°W) had northerly 47-kn winds as the 992-mb storm pushed northeastward. At 1200 on the 14th the extratropical storm was due north of tropical hurricane Gloria. Lima had 40-kn southerly winds on the 15th. Icelandic fishing vessels were reporting gales. The storm brushed the south coast of Iceland that night. By this time Gloria was extratropical, and the TFL DEMOCRACY was near the center (44°N, 31°W) and measured 45-kn winds. The storm raced into the Greenland Sea. On the 16th the 138-ton trawler KIRVIK sank in the North Sea when the cargo shifted in heavy weather.

This was the extratropical conversion of hurricane Frederic. The storm moved up the west side of the Appalachian Mountains. On the 15th the LOW was near Quebec. The circulation was elongated along the coast. The CANADIAN OWL was off Cape Hatteras in 38-kn southwesterly winds and 30-ft seas and swells. Winds were generally in the gale category. A ship reported 20-ft waves off Newfoundland on the 16th. The CAPE ROGER had 50-kn winds and 25-ft waves as the storm passed to the south. OWS Charlie measured 21-ft swell waves. At 1200 on the 17th the 974-mb storm was south of Iceland. It had a large circulation north of latitude 50°N. On the 17th and 18th there were reports of waves near 20 ft. As the storm passed near the Faeroe Islands it suddenly disappeared. The 499-ton AUSTRI capsized on the 19th south of Sognefjord in heavy weather associated with the remaining cyclonic circulation. Four of the nine crewmembers were saved.

This storm was the combination of three LOWs. They were all headed toward the Labrador Sea. At 1200 on the 20th, one was near Cape Chidley, another over the Davis Strait, and the third near Goose Bay. The SEDCO 707 reported 38-kn winds.

By 0000 on the 21st these three centers had combined into one 975-mb center off Godthab, Greenland. A ship with 982 mb south of the center had 35-kn winds. Another in Davis Strait had 44 kn out of the north. OWS Charlie was on the outskirts of the storm with 39 kn and 20-ft seas.

The storm had been traveling northward, but late on the 21st it was drawn back southward as another LOW formed on the east coast of Greenland. On the 22d the original storm disappeared.

This storm came out of central Canada moving parallel to the Canadian border. The center moved over the Labrador Sea on the 22d. On the 23d a ship near 55°N, 50°W, in the southerly flow had 20-ft seas. The DORDRECHT was farther west with 35-kn winds and 16-ft swells. The CAST BEAVER (53°N, 40°W) was sailing into 40-kn winds and 20-ft swell waves.

As the 984-mb storm traveled between Kap Farvel and Iceland, a wave moved east of Newfoundland and the gradient between the wave and the Azores High tightened. The PACIFIC HIGHWAY was in that area with 40-kn winds and 26-ft swell waves. On the 24th this 972-mb storm was centered near Iceland. It was the major cyclonic circulation over this ocean. A Belgium ship south of Iceland and west of the Shetland Islands had 21-ft waves. The DELTA DRECHT (59°N, 36°W) was contending with 42-kn winds, 20-ft seas, and 36-ft swells. Over on the Labrador Sea a trough passed the PETREL at 55°N, 58°W, with winds over 50 kn. The LOW was moving northward over the Greenland Sea, but the SPEY BRIDGE was still being affected by it at 51°N, 39°W, with 50-kn winds and 26-ft waves. The storm then turned eastward and moved over the Barents Sea. The 499-ton WHESTTRADE encountered winds of force 11 to 12 between Archangel and Warrenpoint, Ireland, and 71 packages of timber were lost overboard. The 1,589-ton GALLIC MINCH encountered heavy weather near Norway on the 26th, and the starboard anchor tore off double plating.

This last storm of the month was first found over Goose Bay on the 27th on the 0000 analysis. In 12 hr the pressure dropped from 996 mb to 987 mb as it moved southeastward and the circulation expanded. This expansion included a frontal wave near 44°N, 43°W. The ADMIRAL WILLIAM M. CALLAGHAN and the SEA-LAND GALLOWAY were on opposite sides of the wave with 40-kn winds and 18-ft seas, respectively. By 0000 on the 28th the 970-mb storm was near 53°N, 44°W. OWS Charlie had 45-kn winds blowing heavy rain and 21-ft seas. Many ships had gales. During the day other ships had winds over 50 kn and waves as high as 33 ft. These included the ASIAN FOREST and the DART ATLANTIC. The wind-wave analysis showed a large area near 50°N between 40° and 50°W with seas over 18 ft.

The storm system was moving eastward very

slowly. Several ships had waves over 30 ft as did OWS Charlie. The highest noted was 39 ft near 47°N, 45°W. Winds in the 40-kn and waves up to the 20-ft range continued into October 1. The storm was now traveling northward and weakening. Swell waves of 20 ft were still attacking Charlie. By the 3d the storm dissipated over Greenland.

Tropical Cyclones--The annual North Atlantic tropical cyclone article can be found on page 88.

Casualties--The 35,588-ton American tanker CHEVRON HAWAII was struck by lightning and exploded on the 1st while unloading at Houston, Tex. Several persons were killed, and the fire spread to other facilities. The 425-ton Greek ARIS IV went aground on the 1st on the coast of Libya in fog. The 2,646-ton PACIFIC INSTALLER lost one anchor and 485 ft of anchor wire on the 6th at Maui field. On the 12th the 2,824-ton CARMEN DEL MAR and the ESCANDINAVIA collided in fog near Corunna. The 3,018-ton MOUNT HORIZON ran aground west of Punta Buey on the 17th during hurricane Henri. The Danish ferry KONG FREDERIK IX (4,084 tons) struck a pier at Puttgarden, West Germany, on the 20th in fog. Late on the 21st the 297-ton PULPA grounded in heavy weather south of Sognefjord. The crew was rescued by the BERGEN KREDS.

The 8,878-ton Greek STAMATIOS G. EMBIRICOS and the COTNARI collided in fog on the 24th in Constantza Roads. The 8,127-ton ALEX STEPHENS contacted the stern of the French destroyer DU CHAYLA in thick fog in the Suez Canal on the 25th. The 859-ton Greek MAKEDONIA sank off Cyprus on the 28th after developing a list in a storm.

SMOOTH LOG, OCTOBER 1979--In general the tracks of low-pressure centers were randomly scattered from the latitude of the Ohio River northward, east of the Rocky Mountains. There was a tendency of the tracks to group over the Great Lakes and up the U.S. East Coast to the vicinity of Newfoundland. Storm centers north of latitude 55°N tended to turn northward and dissipate as they approached Baffin Bay. The Great Lakes and East Coast storms joined over Nova Scotia to form the primary path. Southwest of Iceland the paths split again with some moving over the island and the others moving southeastward toward the Bay of Biscay. Climatology indicates three primary tracks; one from the Great Lakes into the Labrador Sea, another from the East Coast to Iceland, and the third from off the East Coast to the Faeroe Islands.

The Icelandic Low at 996 mb was normally located at 60°N, 28°W, 5 mb lower than normal (fig. 35). The 1023-mb Azores High was 4 mb higher than normal near 32°N, 35°W, and 5° longitude west of its usual position. The largest anomaly center was minus 9 mb west of Lands End. This negative area covered the northeastern part of the ocean north and east of a line from the Azores to Kap Farvel. Another negative elongated anomaly stretched from the Great Plains to Newfoundland with a 5-mb center. There was a positive 4-mb area over the central ocean associated with the Azores High.

The upper air flow at 700 mb was mainly zonal over the water with an anomalous closed LOW northeast of Kap Farvel. The trough over the U.S. East Coast was

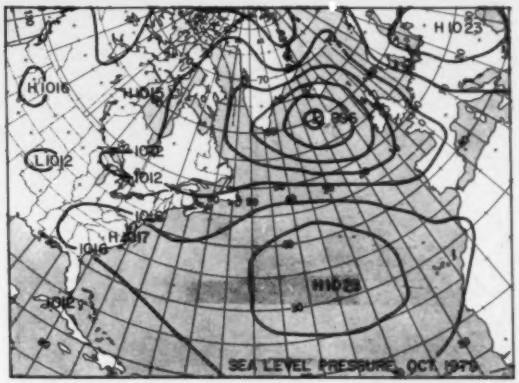


Figure 35.--October 1979 mean-pressure chart.

normal, but the one over the west coast of Europe was much sharper than normal. The ridge over central Europe was accentuated.

Although October is normally an active month for tropical-cyclone activity, there were no hurricanes nor tropical storms during the month. This is the only year on record in which there were eight or more storms prior to October and none during October. The only tropical cyclone during the month was a tropical depression which followed a meandering track in the northwest Caribbean Sea from the 12th to the 18th. A low-pressure system which showed some characteristics of a tropical storm developed south of Bermuda on October 23. Winds in this storm reached 75 mi/h as it crossed the North Atlantic shipping lanes before reaching Newfoundland on the 25th. This subtropical storm is described in the annual article on page 88.

Extratropical Cyclones--There were more than usual especially severe storms this month. Most of the severe weather occurred over the eastern half of the ocean north of the Azores. Several storms could easily qualify for the Monster of the Month.

The first storm was a weak LOW over Cape Hatteras on the first day of the month. On the 2d a ship near 37°N, 67°W, reported 25-ft swell waves on the northwest side of the well entrenched Azores High. After the LOW passed over Newfoundland on the 3d, it started deepening. A tornado was triggered at Windsor Locks, Conn., killing three and injuring 400. Between 0000 and 1200 on the 4th the pressure plunged 17 mb to 975 mb near 53°N, 32°W. Another closed 986-mb center had formed south of the primary center near 44°N, 25°W. The SMAA was east of this one with 55-kn winds. The TROLL PARK was south of the northern center with 45-kn winds, and the CARCHESTER was west of the center with 24-ft swells. At 1800 the AMERICAN LEGEND had 30-ft waves. On the 5th the AMERICAN ARCHER was 500 mi to the southwest with 28-ft waves. The ARTEMIDA had 50-kn winds. Winds of 50 to 55 kn continued south of the primary center. At 1200 the BRITISH TAMAR was 600 mi southwest of the 966-mb center (51°N, 25°W) with 20-ft seas and swells coded at 60 ft. The AMERICAN LE-

GEND was now near 47°N, 29°W, with 55-kn winds and seas of 41 ft. At 1800 they were 49 ft.

On the 6th the winds were generally up to 45 kn, but the BURGENSTEIN, near 44°N, 20°W, found 55-kn winds, while the AMERICAN LEGEND continued to match that speed along with 49-ft waves. Other wave reports were 30 ft or higher. The secondary LOW had disappeared, but another formed on the 7th as the primary LOW started tracking northward. The winds were now in the 30's and waves in the 20's as the LOW was weakening. On the 8th a thunderstorm was reported by the LOIRE with the passage of a trough. By the 9th the primary LOW had dissipated, and the secondary LOW became the primary one. It stalled near 55°N, 15°W, to eventually disappear on the 12th.

A LOW tracked out of the Plains and across the Lakes. On the 1200 chart of the 9th another LOW formed east of this one over the Hudson River, and the new one moved over the water. It was moving south of a LOW over the Labrador Sea. The OLAU WEST was near Kap Farvel with 50-kn winds and 26-ft seas. The Hudson River LOW was racing eastward. On the 11th it joined the circulation of the previously described stationary LOW. As it sailed past OWS Charlie early on the 11th, she had 50-kn winds and 20-ft seas. At 1200 the winds were only 40 kn, but the waves were 30 ft. The AYAKS was to the north (61°N, 28°W) with 62-kn winds and 26-ft seas.

At 1200 on the 12th the 978-mb LOW was off Fastnet Rock. This was a bad day. The SPRAY CAP reported 68-kn winds near 41°N, 25°W. Several other ships had winds over 50 kn. The worst part were the waves. OWS Romeo suffered the worst with 46-ft waves. Among others the CIROLANA and GLENPARK had waves over 30 ft. The storm was moving southeastward into the Bay of Biscay. Waves of over 30 ft continued into the 13th.

On the 14th a maverick LOW moved into the northern part of the circulation, bringing in a new shot of energy. The PEARL ACE found that 46-ft area of waves. The SEA TRAIN LE HAVRE had 33 ft. The LOW moved ashore in Bordeaux country as the second LOW followed in a southeastward path. A third LOW now formed near Cape Finisterre.

At 1200 on the 15th this new LOW was 987 mb over northwest Spain. An area of high waves existed between 35° and 50°N and 10° to 20°W. The QUEEN ELIZABETH 2 (39°N, 13°W) had 39-ft waves, and the ROCKHAMPTON STAR (40°N, 13°W) had 41-ft waves. The winds were generally in the 40-kn category. On the 17th this LOW moved over Italy and disappeared.

This was one of the storms that traveled across the Great Lakes. It brought rain to the basin and snow north of Lake Superior. It was not a deep LOW at this time, only 996 mb at 0000 on the 13th. Between 1800 on the 12th and 1200 on the 13th, five ships on Lakes Superior, Michigan, and Huron had winds over 40 kn. The highest was 52 kn on Lake Superior, measured by the ARTHUR M. ANDERSON with 12-ft waves. The LOW crossed into the Labrador Sea on the 14th. Early on the 15th the SEDCO 709 (47°N, 47°W) found 47-kn southerly winds. Later in the day the FRITHJOF was north of the center near 60°N, 46°W, with 70-kn northeasterly winds and 31-ft waves.

On the 16th the LOW glanced off the west side of Kap Farvel and traveled up the west coast. OWS Charlie had 24-ft waves as the occluded front passed. Another center materialized off the east coast and moved northeastward as the original LOW died on the barren west coast.

This LOW formed in a trough line that swung around the storm described above. A small center had formed by the 17th. A front had generated in the trough, and at 1200 on the 17th the USNS COMET and the JEAN LYKES were near the front (39°N, 39°W) with 58- and 48-kn winds, respectively. The center passed north of Charlie on the 18th, leaving 20-ft seas. The EUROBRIDGE BEAM (54°N, 33°W) and the MANCHESTER RENOWN (56°N, 26°W) both had 52-kn winds with the formed reporting 26-ft seas. Lima had waves of 25 ft on the 18th and 30 ft on the 19th. The 976-mb storm touched the southeast Iceland coast at 1200 on the 19th. The storm disappeared into the Barents Sea on the 21st.

This frontal wave was first analyzed on the 1200 chart of the 20th. Ships from Britain, Germany, and the United States were instrumental in identifying this new development. It intensified quickly to 990 mb near 47°N, 30°W, by 0000 on the 21st. At 1800 on the 20th the NORSE VIKING (42°N, 36°W) was hit by 68-kn winds, and at 0000 on the 21st the NOVO MESTO (41°N, 36°W) had 60-kn winds. Slightly farther north (44°N, 36°W) the JADRON was pounded by 46-ft waves.

As the storm moved northward it deepened to 976 mb at 1200. The high wind band had moved northward as well as eastward to longitude 28°W. The CAST PORPOISE and DURHAMBROOK both found 55-kn winds at that longitude with the latter having 33-ft waves.

On the 22d the storm was approaching the Denmark Strait and curving westward. The GTOT (58°N, 09°W) found 50-kn winds in the southerly flow and 33-ft swell waves. On the 23d the rugged coast of Greenland took its toll.

The wild west of Montana produced this storm on the 19th. It raced across the Quebec and Labrador provinces at 55 kn and moved offshore near Hamilton Inlet early on the 22d. A good westerly flow already existed between a LOW over the Denmark Strait and the Azores High. At 1500 the WIDAR was near 54°N, 48°W, with 53-kn winds, when the LOW passed slightly to the north. By 0000 on the 23d OWS Charlie had 40-kn winds and 21-ft seas. At 1200 the LOW was 958 mb near 59°N, 28°W. A Soviet ship reported 68-kn winds and 26-ft seas near 57°N, 30°W. The NORDVIKINGUR at 60°N, 20°W, on the eastern side found 60-kn winds. At 1800 a French ship (FBLD) (60°N, 50°W) found a 70-kn wind band. The HOFSJOKULL (55°N, 37°W) was in 60-kn westerlies. Charlie now had 30-ft waves, and the same Soviet ship as before had 33-ft waves.

Winds over 50 kn were still being reported on the 24th. For two ships high waves were the problem. The WELSH CITY (48°N, 27°W) was beaten by 43-ft waves. The passengers on the QUEEN ELIZABETH 2 (48°N, 32°W) were not enjoying their voyage with 41-ft waves crashing on the deck. There was a long slender area of high waves oriented northwest-southeast approximately centered on OWS's Charlie and Romeo.

On the 25th the strong southerly winds had reached the North Sea and were pounding the platforms with 40- to 50-kn winds and waves as high as 30 ft. The LOW

had now curved toward the northwest, and the pressure was rising. On the 26th two new LOWs formed in the outer circulation. One of these passed almost directly over OWS Lima. That day the storm suddenly started moving eastward again, then northward to crash on the Greenland coast.

These two ships probably suffered their heavy weather damage with this storm. The 1,596-ton British ELOISEID encountered heavy weather between the 23d and 26th between England and Finland. The 6,640-ton Cuban 5 DE SEPTIEMBRE from Cuba to Rotterdam sought refuge at Lisbon on the 26th because of severe weather.

This storm began as a weak frontal wave between Bermuda and Cape Hatteras. It moved northeastward along the front until the 27th, when it started to deepen. At 1200 on the 28th the 992-mb storm was 200 mi east of Cape Race. The USNS COMET (36°N, 51°W) was east of the cold front with 48-kn southerly winds. At 1200 on the 29th the LOW was 976 mb near 53°N, 40°W. At 0600 the LOW had passed very close to the BILDERDYK with a pressure of 981 mb, 52-kn southerly winds, and 25-ft waves. At 1200 the wind was northwesterly at 50 kn and the waves 23 ft. At 1800 a SHIP report read 74-kn winds at 55°N, 85°E, which is in central Siberia. A wrong quadrant indicator I hope. On the 30th several ships reported winds near 50 kn, but most reported strong gales. Waves were up to 25 and 30 ft. At 1200 the LOW passed almost directly over OWS Lima with a pressure of 973 mb at Lima. As the center moved northward her winds picked up to 45 kn and the seas to 21 ft.

On the 31st the storm was nearly stationary near 62°N, 18°W. During the day Lima measured winds up to 60 kn. The platforms in the North Sea were straining under winds up to 65 kn at one near 61°N, 01°E. The RIG MASTER (60°N, 02°E) had 63 kn and waves of 39 ft. By 1200 on November 1 the 978-mb center was over Iceland and deteriorating as another LOW approached from the southwest. The storm disappeared on the 2d.

This severe weather over the Mediterranean was associated with a frontal system that was over the area from the 25th to the 27th. On the 25th 5 hr of torrential rain flooded Catania, Sicily. Two people were killed, and there was millions of dollars damage. The same day a severe thunderstorm struck the Maltese Islands and 68.2 mm of rain fell at the airport in a short time. Three people died in the worst storm to hit Malta in 25 yr. Severe flooding caused much damage.

On the 27th the 1,600-ton Cypriot NICOS developed difficulties in severe weather west of Marseilles and was taken in tow to the Gulf of Fos. The same day the tug HANSA lost tow of the Tunisian MONASTIR near 36.2°N, 20.2°E, during a storm. The MONASTIR was later found aground on the southeast tip of the Gulf of Taranto.

At the same time Upper Egypt suffered the worst floods in 25 yr. The last count indicated that 42 people had been killed and 25,000 were homeless. Torrential rains wrecked villages, roads, and bridges; drowned animals; and destroyed crops.

Monster of the Month--This storm came from the Great Lakes. As it passed south of Newfoundland on

the 31st the CAPE ROGER had the first gales and 16-ft seas. A ship near Miquelon Island had 45 kn. As the previous storm dissipated this one intensified. There was a long sweep of cold air behind the storm from Greenland to 25°N. A ship had 50-kn winds near Frederikshab. The KBCG (47°N, 47°W) had 47-kn winds and waves up to 20 ft were reported in the northerly flow.

On the 2d a second LOW joined the overall circulation south of the original one. The ORJEN near 45°N, 47°W, found 55-kn winds from the north. Some waves were running up to 20 ft. At 0000 on the 3d the LOW had plunged to 958 mb. The buoy southwest of Iceland measured 40-kn winds. The drilling platforms in the North Sea were again being hit by winds over 50 kn. Waves over 30 ft were not odd. One near 61°N, 01°E, reported 52 ft; others were near 40 ft. Ships were not being discriminated against. OWS Mike measured 60-kn winds and 20-ft seas. The ECKERT OLDENDORFF (59°N, 22°W) found 56-kn winds and 46-ft swells at 1200. On her 1800 report the winds were 122 kn, but this was probably double the speed due to the conversion indicator. The observation was fantastic as the seas converted to 49 ft and the swells to 80 ft. The observation looked good as far as pressure, temperature, position, movement, etc., were concerned. On the 4th the C. P. DISCOVERER along 54°N reported swell waves of 49 ft twice. A platform near 62°N, 01°W, measured 46 ft waves. The storm was moving across the Norwegian Sea with a pressure of 949 mb. The storm finally broke up over northern Scandinavia.

This storm took its toll. The 8,633-ton Panamanian LEVANTINO suffered hatch cover damage on the 3d between Narvik, Norway, and Glasgow, Scotland. The 6,500-ton Greek freighter AEOLIAN SKY and the 1,000-ton West German cargo ship ANNA KNUPPEL collided in the stormy English Channel 30 mi southwest of the Isle of Wight. That same day the British motor vessel SAINT KENTIGERN ran aground on West Burra Isle in the Shetlands in force 9 to 10 winds. She sank almost immediately. The crew of six was later rescued from a liferaft by the ALERT. Early on the 6th the 1,028-ton POOL FISHER capsized in force 6 to 7 winds and rough seas off the Isle of Wight. There were only 2 survivors of the crew of 14, plus a wife.

Casualties--The 6,792-ton Great Lakes freighter FORT WILLIAM struck the Detroit River Light in heavy fog on October 1. The Spanish trawler NUEVO JORGE was stranded in fog near Cabo Quintres on the 1st. The British fishing vessel CONDUAN ran aground on Brown Point in fog on the 3d. The Dutch

1,599-ton LEIDSEGRACHT suffered damage in heavy seas on the North Sea on the 4th. On the same day the new floating drydock No. 910 broke loose in 60-kn winds from towing tugs. It went aground near 69.8°N, 31°E. The dock was designed to take vessels up to 150,000 tons. The 14 crewmembers were taken off by helicopter. The British fishing vessel MARGRETHE BOJEN capsized in the North Sea in 45-kn winds on the night of the 4th. All six crewmen were missing. The British fishing vessel ELLA GRETHE and the motor vessel BULKO collided in fog 20 mi east of Ekofisk. The former sank and the BULKO picked up her crew. The 6,376-ton Panamanian GABRIELE KOGEL reported heavy weather damage on the 13th at Szczecin, Poland, on a voyage from Brownsville. The 2,798-ton ferry BALTIC STAR ran aground outside Stockholm harbor in fog late on the 13th. All 350 passengers were safely evacuated. The Greek ANGELIKI suffered heavy weather damage on the 13th, 14th, and 15th from Santos to Malaga. The 500-ton Panamanian TRANSMAR ran aground in a heavy rainstorm in Port Au Prince Bay on the 14th.

Two tidal waves with crests up to 10 ft hit the French Riviera about 1400 local time on the 16th. The sea pulled back up to 300 m, a drop of about 1 m, then surged ashore. Hundreds of boats were swept from their moorings, and many cars on coastal roads were engulfed. About a dozen people were drowned. Many were working on a breakwater at Nice. Many buildings were also damaged.

The 912-ton Norwegian BJORGVIN grounded in fog early on the 16th at Laksevag. All passengers were safely landed at Bergen. On the 17th the 7,538-ton ROMANZA embedded her bow in a rock face on the Greek island of Dhenousa in fog. All passengers and crew were transferred to other vessels. The British bulkcarrier LA CORDILLERA (25,552 tons) and the Greek tanker GEORGIOS (23,451 tons) collided in fog in the Dardanelles. The LA CORDILLERA later ran herself aground. The 2,627-ton KAPRIJE sank after a collision in fog with the 10,690-ton SOULA K in the Aegean Sea. Eighteen of the crew were missing.

The AEGIS PIONEER was stranded on the River Seine in heavy fog on the 20th. The U.S. Great Lakes freighter G.A. TOMLINSON (6,598 tons) was blown against the harbor breakwall at Ashtabula, Ohio, on the 28th.

Other Casualties--The American cargo vessel PILGRIM sent a distress message after her cargo shifted in heavy seas and huge swell off Cape Town. The Panamanian ARAMBEE, assisted by a tug, collided with the TURGUT GUNERI while unberthing at Assab. She was in ballast and drifted in strong winds.

Smooth Log, North Pacific Weather

September and October 1979

SMOOTH LOG, SEPTEMBER 1979--There were several large, deep storms this month. This seems earlier than usual in the fall season for their development. There were two distinct primary storm paths. The southern one was from west of Tokyo eastward and then northeastward into the Gulf of Alaska. The other was from the Kuril Basin northeastward into the Bering Sea. There also was a secondary track out of Asia and across the Sea of Okhotsk into the Bering Sea. These tracks grossly matched the climatological tracks. The primary track into the Bering Sea corresponded to a climatic secondary track.

The mean sea-level pressure pattern matched the climatic mean closer than the storm tracks (fig. 36). The 1003-mb Aleutian Low was near Shumagin Islands east of the Alaska Peninsula. Its 1006-mb climatological counterpart is south of Bristol Bay and west of the Alaska Peninsula. The Pacific High was 1021 mb, which matches climatology. It was centered near 34°N, 158°W, which is about 600 mi west of its normal location. There was an anomalous 1019-mb high-pressure center near 32°N, 160°E, which produced a large anomaly area of about 3 mb stretching southeastward from northern Japan to approximately 180°.

There were two principal negative anomaly centers over the northern ocean. The largest was minus 6 mb over the Gulf of Alaska near 52°N, 150°W, and the other was minus 4 mb over the western Bering Sea north of the Near Islands.

In the upper air at 700 mb the flow was mainly zonal between latitudes 35° and 55°N. The constant pressure surface was generally higher than normal south of 40°N and lower than normal north of that latitude. The major trough stretched from the North Pole southward across the Bering Strait into the Bering Sea. There was secondary troughing on both the east and west sides. This troughing was especially pronounced off the west coast with an attendant sharpening of the normal ridge over the West Coast mountains.

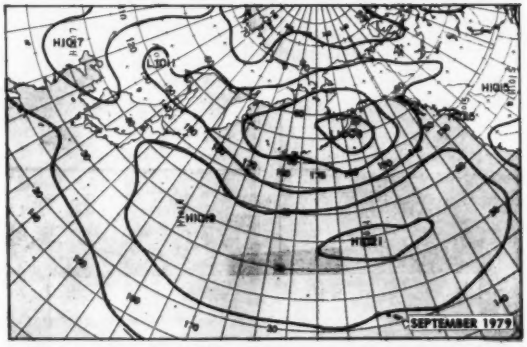


Figure 36.--September 1979 mean pressure chart.

Hurricane Guillermo was over the eastern Pacific. The western Pacific hosted six cyclones: typhoons Lola and Owen and tropical storms Ken, Mac, Nancy, and Pamela.

Extratropical Cyclones--This storm was the extra-

tropical stage of tropical storm Ken, which began in August. Ken turned extratropical on the 4th over Honshu. The PRESIDENT WILSON was near 44°N, 149°E, on the 5th with 60-kn southerly winds. By 0000 on the 6th the storm had dropped to a pressure of 984 mb near Ostrov Simushir. At 1800 on the 5th Russian ships on the Sea of Okhotsk had started to report winds up to 58 kn. These strong winds on the western side of the storm continued with wave reports from some ship building to over 20 ft. A ship near the warm front in the eastern half near 45°N, 156°E, reported 23-ft swell waves. At 1200 the CHITA MARU also near the warm front but at 45°N, 163°E, had 38-kn winds with 30-ft swell waves, 70° out of phase with the southeasterly wind waves. By the 7th the swell waves had increased to 33 ft and were nearly in phase with the wind waves. The storm was traveling northeastward and filling. On the 8th it moved into the Bering Sea and dissipated on the 10th.

This storm was the offspring of a combination of a frontal wave with dissipating tropical cyclone Lola on the 8th. At 0000 on the 9th the THOMAS E. CUFFE was 120 mi south of the wave with 45-kn winds and 20-ft seas. The storm continued an easterly track until the 11th with winds under gale force and then turned northeastward. On the 11th the winds started increasing as did the waves. At 1800 the NOPAL LANE found 26-ft swell waves in the southeast quadrant of the storm, while the YAMASHIN MARU nearby had 50-kn winds and 16-ft waves.

The storm was now deepening rapidly, and at 0000 on the 12th the 965-mb storm was near 47°N, 156°W, occupying a large area of the ocean. The GLACIER BAY (45°N, 152°W) was battered by 50-kn winds and 33-ft waves at 0600. The ZENKOREN MARU (42°N, 155°W) had 46-kn winds and 16-ft waves, while the HIEI MARU (44°N, 155°W) had 35 kn and 26-ft swell waves. The GLACIER BAY was slammed by 35-ft swell waves at 1800, which were still 33 ft the next day.

On the 13th the storm was over the Gulf of Alaska. A ship near 51°N, 139°W, had 54-kn winds out of the south. The PRIOZERSK 550 mi away from the center in the southwest quadrant had 50-kn winds. The PACPRINCESS over the Gulf found 30-ft swells rolling from the south. Early on the 14th the storm was still able to produce 50-kn winds as attested to by the PACIFIC VENTURE and the TOYOTA MARU, which also found 25-ft swells east of the storm. The storm was dying rapidly as it turned northwestward across the Alaska Peninsula.

This was a long-lived storm. It took many ship reports to trace its path from Japan to the Gulf of Alaska. The first indication of the LOW was a frontal wave to the south of Tokyo. It slowly traveled east-northeastward under the influence of upper zonal flow. By the 13th it had developed a considerable circulation, but the winds and waves were not severe. At 0600 on the 14th the first significant wind and wave report of 45-kn winds and 20-ft waves was received from the YAMASHIN MARU (44°N, 175°E) near the center of the storm.

When the preceding storm crossed into the Bering Sea and weakened, this storm blossomed. At 0000 on the 16th it was 981 mb near 53°N, 157°W. The report from Adak Island indicated winds of 60 mi/h. The TOMEI MARU (51°N, 154°W) found 48-kn winds. The ATLANTIC PIONEER (51°N, 165°W) was buffeted by 23-ft waves. A German ship also had 23-ft waves almost 300 mi south of the LOW on the 17th. The higher winds were blowing around 40 kn. An American ship was sailing toward the LOW with 25-ft waves. The storm turned sharply eastward on the 17th and weakened as it broke away from its primary upper air support.

Another of those situations where a LOW splits across a peninsula or sharp point of land. This LOW east of the Kamchatka Peninsula split off another LOW that was over the Sea of Okhotsk on the 16th. By 1200 on the 17th it was 980 mb near 57°N, 172°E. The GOLDEN BEAR was far to the southeast with 40-kn winds.

Among the contributors on the 18th were the ASIA HONESTY, PACIFIC VENTURE, and TOYOTA MARU. They reported winds up to 43 kn and waves up to 20 ft. A Japanese ship in the southerly flow reported swell waves of 43 ft from the southwest. The ATLANTIC PIONEER (51°N, 180°) over 500 mi south of the 978-mb center had 29-ft waves. The storm was moving eastward along 60°N. On the 20th the storm skirted Cape Romanzof and sank in Norton Sound.

Northern China produced this storm. It moved over the Tartar Strait on the 18th and the Kuril Islands on the 19th. At 0000 on the 20th the analysis showed a 995-mb central pressure, and the AMAX MACGREGOR at 47°N, 162°E, indicated 995 mb with 36-kn winds and 23-ft waves. At 0600 a SHIP near 48°N, 166°E, had 990 mb with 55-kn winds. They didn't venture out to check the waves. By 0000 on the 21st the 980-mb storm had traveled to 51°N, 178°E. The PACPRINCESS was near 50°N, 173°E, with 40-kn winds and 36-ft waves. Farther to the southwest the ATLANTIC PIONEER (47°N, 172°E) was in 45-kn winds and 25-ft waves.

The storm was moving along the Alaska Peninsula on the 22d at 980 mb. The PORTLAND was sailing southeastward with southerly 50-kn winds and 20-ft swells out of the southwest. The storm moved northward across western Alaska and into the Chukchi Sea on the 24th.

Another of those storms that was split by the Kamchatka Peninsula. The original LOW had come out of northern Manchuria. This was a deep LOW and strong storm at its inception late on the 23d. The cyclonic circulation was already present, only the center changed. At 0000 on the 24th it was 970 mb near Ostrov Mednyy. One of the Kuril Islands measured 40 kn. A Soviet ship (USZL) (49°N, 154°E) radioed 54-kn winds and 41-ft waves. The NELSON MARU (51°N, 168°E) had 52-kn winds, but only 18-ft seas. At 0600 the HERCULES BULKER at 47°N, 164°E, reported winds of 60 kn. The LONG BEACH measured 48-kn winds and 30-ft waves.

At 1200 on the 24th Ostrov Beringa measured 50-kn winds, and a ship at 53°N, 174°E, had a pressure of 965 mb and winds of 50 kn. The SOUTH EXPRESS and CRESSIDA had 30- to 35-ft waves in the southwest quadrant. The storm was near the center of the Bering Sea on the 25th and the pressure had dropped to 958 mb. The HIRO MARU (52°N, 177°W) reported 59-kn winds. Several ships inside the 1000-

mb isobar had 50-kn winds and many gale reports. On the 26th the storm stalled near 62°N, 172°W. Although the winds were decreasing, there were still high swell waves. On the 27th the SINCERE No. 5 (50°N, 146°W) had 33-ft seas and 38-ft swells. The storm fizzled away and disappeared on the 29th.

This was a fast-moving frontal wave on the front out of the storm above. This time the zonal flow sent it racing eastward. At 0000 on the 27th it raced by the BREWSTER at 39°N, 178°E, leaving a 53-kn memoir. The PRESIDENT FILLMORE received the same treatment at 1800 near 44°N, 159°W. The winds were only 40 kn, but the waves were 23 ft, and 30 ft 9 hr later. The storm began to intensify rapidly on the 28th, which slowed its forward dash. The HONSHU GLORIA measured 62-kn winds almost in the center, and the GLACIER BAY reported 33-ft waves on the 28th and 29th.

The 976-mb storm was not so large or deep as the others, but it stirred up the water. The RIPON GRANGE (45°N, 144°W) found 55-kn winds, 33-ft seas, and 49-ft swells. The PRESIDENT FILLMORE (43°N, 148°W) in a lesser gradient had only 37-kn winds with 36-ft swells. The storm touched the Canadian coast at 0000 on the 30th and was gone by 0600.

The Sea of Japan spawned this storm on the 26th. After crossing Honshu it raced eastward across the water. The storm suddenly started deepening late on the 28th, and by 1200 on the 29th it was 964 mb near 49°N, 167°W. That day several ships had 50-kn winds and seas to 30 ft. Those reporting high winds and seas included the BENHOPE and VIOLET. Twenty-four hours later on the 30th the storm was 950 mb near buoy 46003. At 0000 a Japanese ship was within 5 mb of the center with 26-ft seas. The TSURUMI MARU was about 540 mi south of the center with 43-kn winds and 30-ft swell waves. The HAN WOO (54°N, 159°W) had winds over 50 kn and 33-ft seas. The RIPON GRANGE, 850 mi southeast of the center, reported 30-ft swell waves. At 1800 OWS Papa measured 40-kn winds and 26-ft seas.

The strong winds and high seas continued into October 1 as the storm entered the Gulf of Alaska. Papa now had 42 kn and 27-ft waves. At 1200 the storm was over Kodiak and weakening rapidly. It dissipated on the 2d as another LOW moved into its circulation.

Tropical Cyclones, Eastern Pacific--In this month's only action, hurricane Guillermo was first spotted on the 8th near 16°N, 100°W. He moved in a northwesterly direction, reaching tropical-storm strength on the 9th. The following day Guillermo, still a minimal tropical storm, crossed 20°N near 110°W. On the 11th he slowed and drifted northward. He also intensified briefly, reaching minimal hurricane strength for a few hours late on the 11th and early on the 12th. However, Guillermo then stalled and fizzled.

Tropical Cyclones, Western Pacific--The first warning on tropical storm Ken was issued on the 1st. He was just a depression some 240 mi east of Naha, Okinawa. Ken swung northward. He reached tropical-storm strength on the 2d as winds climbed to 45 kn. However, he was approaching Kyushu and was not able to strengthen further. Ken dissipated over southern Japan on the 4th.

Meanwhile, typhoon Lola was developing between Marcus Island and Iwo Jima. By late on the 4th she reached typhoon strength just before crossing the 20th parallel near 147°E. Lola moved northward then northeastward. Winds near her center reached 80 kn on the 6th. The following day she fell back to tropical-storm strength after crossing the 30th parallel near 146°E. Fortunately, Lola remained far from land, and there were no shipping incidents reported.

After about a week's lull tropical storm Mac popped up in the Philippine Sea. On the 15th he was spotted near 13°N, 131°E. Before he banged ashore in the central Philippines on the 18th, big Mac generated 55-kn winds near his center. His trek across the islands, south of Manila, left him weak. Winds dropped below tropical-storm strength by the 20th. Mac was now heading northwestward across the South China Sea. By the 22d, on a course for Hong Kong, Mac regained tropical-storm strength. He moved into Hong Kong the following day. Heavy rains lashed the island and many roads were closed by fallen trees and landslides. Rain totaled more than 9 in in parts of the colony. At least one death was reported and 67 injured. For a more detailed report on Mac and Nancy, see page 12 of the January 1980 issue.

Between the time that Mac left Manila and arrived in Hong Kong tropical storm Nancy had come and gone, and typhoon Owen had been born. Nancy kicked up just off the coast of Hainan on the 19th. After crossing the island she headed southwestward for Vietnam. A minimal tropical storm, Nancy brought heavy rain to the area just north of Hue. She fizzled as she continued across the rugged terrain into Cambodia on the 22d.

It was on this same day that Owen was discovered some 200 mi north of Yap. He developed as he moved along a north-northwestward track. Owen reached typhoon strength on the 24th after crossing the 20th parallel near 133°E. By the 27th he was generating 100-kn winds close to his center. The GENCIANO, carrying lumber from Borneo to the Japanese port of Hamada, sank in rough seas about 130 mi west of Okinawa. The 23 South Korean crewmen were plucked from a lifeboat by the container vessel ALAND FINANCE. Several U.S. cooperating ships were involved in Owen on the 27th to 29th. The SEA-LAND TRADE was one of the hardest hit with 50-kn winds and 33-ft waves.

Heading northward, Owen passed about 100 mi east of Okinawa, disrupting both air and sea traffic for several days. Ten large oil tankers were forced to leave Tachibana Bay to find refuge at sea as a slowly weakening Owen moved in on Kyushu. The storm made landfall over Shikoku on the 30th. Muroto on the southeast coast recorded a gust of 130 kn as Owen passed over. Waves nearly 33 ft high pounded the southern coast, while heavy rain triggered inland flooding. Owen dumped up to 17 in of rain in 10 hr. On Amami Oshima, south of Kyushu, 27 in of rain fell over the last 3 days. The 2,438-ton ZIJIN SHAN dragged her anchor and struck the breakwater at Wakayama.

From Shikoku Owen made the short hop to Osaka and mainland Japan on the 30th. He continued northeastward across Honshu as a tropical storm, and then moved back out to sea on the 1st. The damage to the island and shipping was heavy.

In his wake Owen left 8 people dead and 51 injured. Some 53 houses were damaged and more than 3,000 flooded. Landslides damaged roads and several com-

munication links. Several ships either sank, grounded, or collided during typhoon Owen. The ZUIN SHAN, taking refuge off Wakayama, dragged her anchor and struck the breakwater causing serious hull damage. The FORTUNE MARINER, taking refuge at Ise Bay, was driven aground. In the same waters the GOLDEN MIRANDA, a bulkcarrier, collided with the ITEL AMERICA when her anchor dragged. A similar accident occurred to the TRISAKTI and the HOTOKU MARU at Shimizu anchorage.

The last storm of the month was short-lived tropical storm Pamela. She was spotted on the 25th midway between Iwo Jima and Guam. As a minimal tropical storm, she traveled northwestward. The following day Pamela recurved northeastward and weakened rapidly.

Casualties--The 13,313-ton Greek bulkcarrier SEMI was due Niigata on the 6th with heavy weather damage. It was reported at Kobe on the 14th that a heavy weather damage survey had been requested for the 12,498-ton Greek AEGIS BRITANNIC. A sister ship, the AEGIS HEROIC advised that she sustained heavy weather damage on voyage from Romania to China.

The 10,039-ton SILVER SHELTON reported heavy weather damage on the 21st on a voyage to Nagoya. The 1,999-ton GENCIANO bound for Japan encountered heavy weather on the 27th about 125 mi northwest of Okinawa and sank. The SEALAND FINANCE responded to the distress call and rescued 23 crewmembers.

Other Casualties--A surveyor was appointed to inspect reported heavy weather damage to the 13,000-ton Liberian AL SAMAD at Basrah, Iraq. The Chief Officer of the 1,776-ton Panamanian INDUNA was rescued from a liferaft 400 mi northeast of Durban after being adrift 24 days. He was picked up by the CONSTANTIA. The vessel sank about 50 mi south of Cap Ste. Marie after taking on water in heavy seas. Both lifeboats turned over when launched, and one self-inflatable liferaft was blown away.

SMOOTH LOG, OCTOBER 1979--The low-pressure center tracks and the pressure pattern were a close match with climatology this month. There were two primary storm tracks. One came out of Siberia across Sakhalin Island, then eastward across the Bering Sea toward the Alaska Peninsula. The other track was from east of Japan, eastward to the central ocean, and then northeastward into the Gulf of Alaska. During the middle of the month two storms approached the California coast.

The 993-mb Aleutian Low was north of Unalaska Island. This was 8 mb deeper and 600 mi southwest of its normal location near Cook Inlet. The Pacific High was its normal 1019 mb astride latitude 30°N (fig. 37).

The major anomaly was minus 11 mb associated with the lower pressure and displacement of the Aleutian Low. Its center was near 55°N, 170°W.

The upper air flow at 700 mb was zonal with a trough over the eastern Asian coast and another along 160°W longitude. There was the usual ridge over the Rocky Mountains, only sharper. There was a closed LOW near the Pribilof Islands in place of the usual trough.

There were five tropical cyclones, two over the eastern ocean and three over the western ocean. The eastern North Pacific hosted tropical storm Hilda and hurricane Ignacio. The western North Pacific hosted tropical storm Roger and typhoons Sarah and Tip.

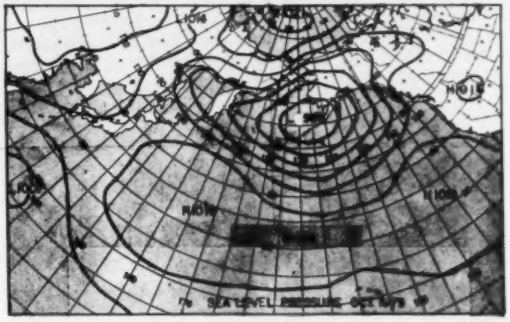


Figure 37.--October 1979 mean pressure chart.

The U.S. West Coast was dry. On the 13th a 34-day period without rain was broken in Seattle when .01 in fell. This was the second extended period of dry weather in 4 mo. The first period was 32 days from July 12 to August 12.

Extratropical Cyclones--The first storm of the month formed over northern Honshu on the 1st as a combination of a weak extratropical LOW and dissipating typhoon Owen. By 0000 on the 2d it was 980 mb near 46°N, 158°E. A number of ships were in the area reporting gale-force winds and greater. The KAMENSKOIE (44°N, 155°E) found 48-kn winds and the highest seas of 34 ft. At 0000 on the 3d a Japanese ship (44°N, 173°E) was pounded by 35-kn winds and 25-ft swells. The BELLMAN (46°N, 177°E) measured 57-kn winds. By 0000 on the 4th the storm was south of Unimak Island at 960 mb. Two ships near the center had 50-kn winds. The OCEAN BOUNTY was near Gore Point with winds up to 48 kn from the southeast. At 1800 the TROPIC FLYER (53°N, 148°W) was tossed by 44-kn winds and 46-ft waves. The PRESIDENT JEFFERSON about 90 mi south had 50-kn winds, but the waves were only 23 ft. On the 5th the NORDPOL (54°N, 152°W) fought 50-kn winds and 31-ft seas. On the 6th the storm broke up.

This storm formed on the 4th as a frontal wave east of northern Honshu as an extension of the front was being drawn into tropical storm Roger. A ship about midway between the two storms (33°N, 147°E) reported 44-ft swells from 200°. At 1200 on the 5th the HERMES (50°N, 162°E) had 980-mb pressure near the center of the storm with 40-kn winds and 20-ft seas. On the 6th the WESER EXPRESS (53°N, 171°E) was north of the center with 45-kn winds and 20-ft waves from the east. The HOHSING ARROW was 1,100 mi northeast of the storm, but southwesterly 33-ft swells were pounding her. The SPRUCE was north of the storm with measured 38-kn winds and 33-ft waves.

By the 7th the 966-mb LOW was near 45°N, 170°W. A Japanese ship (JQVG) at 40°N, 177°W, was in the 55-kn high speed lane with 33-ft waves. At 0900 and 1200 three ships reported waves of 33 ft with two having 50-kn winds in the southwest quadrant. On the 8th most

of the winds were in the gale category; but several ships had reports over 50 kn, including the CHEVRON CALIFORNIA with 65 kn out of the east near Cook Inlet. The TOYOTA MARU near 37°N, 169°W, had two observations of waves over 35 ft. The storm moved over the Alaska Peninsula on the 9th and magically disappeared as the next storm absorbed its circulation.

This storm formed east of Hokkaido on the 6th. It traveled northeastward as a frontal wave for 48 hr. Between 1200 on the 7th and 1200 on the 9th the LOW plunged 44 mb. The upper air support for this LOW moved southeastward from the Kamchatka Peninsula drawing the upper air support from the previous LOW northward and absorbing it. On the 9th the NOPAL LANE (38°N, 178°E) was sailing with 47-kn winds. The PRESIDENT ADAMS at 53°N, 176°E, had 50-kn winds and 26-ft waves, while the OHMINESAN MARU (60°N, 175°W) suffered chilling 55-kn winds out of the northeast with 21-ft waves on the 10th. The OCEAN BOUNTY was near Cook Inlet and reported gusts to 74 kn to WBH 29. The storm was 966 mb at 0000 on the 11th north of Unmak Island. The FINNISH WASA (48°N, 172°W) had winds of 50 kn.

The storm moved across Bristol Bay on the 12th and crashed into Mt. McKinley.

This storm came out of southern Siberia. It managed to cross the Kamchatka Peninsula on the 10th. It drifted over the Bering Sea until the previous LOW moved on. The first 40-kn winds were plotted on the 13th along the western Aleutians. At 0000 on the 14th the 980-mb LOW was near 54°N, 171°W. Another center had formed about 300 mi to the south. The ships had winds of 50 kn or greater. The SHINZUI MARU (49°N, 174°E) was sailing into 55-kn northwesterlies, 26-ft seas, and 30-ft swells. At 1800 the second LOW had been squeezed out, and the LEON PIERRE (49°N, 170°W) had 54 kn and 49-ft waves. On the 15th the PRINCE OF TOKYO (45°N, 168°W) battled 33-ft waves. Several ships had winds over 50 kn.

Between the 13th and 15th fishing vessels along the Aleutians between the Fox Islands and Cook Inlet were battered by winds up to hurricane force. The OCEAN BOUNTY reported swells up to 32 ft at the entrance to Cook Inlet. On the 16th a Canadian ship east of Mackenzie Bay reported, but everything was garbled except its position and call letters--they may have been garbled also as it could not be identified. The storm was rapidly filling as it dawdled south of the Alaska Peninsula until the 18th.

Supertyphoon Tip was declared extratropical on the 20th near Ostrov Urup in the Kurile Islands. It was still an intense storm at 960 mb. At 0000 four ships had winds of 60 kn. They were broadly along longitude 145°E between latitudes 37°N and 44°N. The SINCERE No. 3 had 40-ft waves near 41°N, 152°E. Six hours later the NILE MARU verified the wave measurement only a few miles to the east. At 1200 the island of Ostrov Urup measured 50-kn winds. On the 21st the SKAUGRAN (45°N, 161°E) was braving 48-kn winds and 46-ft swells. As the storm moved across the Bering Sea on the 22d, it disintegrated.

Early on the 20th a cutoff LOW was centered near 33°N, 180°. There were three high-pressure cells northwest, northeast, and east of this LOW. A front stretched northeastward out of the LOW and between the two eastern high-pressure cells. On the 0600 chart a frontal wave formed on the front west of the HIGHs. The high pressure to the east rapidly broke down, and the LOW expanded while moving northeastward.

On the 21st many ships reported 40-kn plus gales south of the center. The ALSTER EXPRESS (42°N, 145°W) had 52-kn winds and 33-ft waves. Two other ships also had 33-ft waves. At 0000 on the 22d the pressure had dropped to 956 mb near 48°N, 141°W. Among others Ocean Weather Station Papa measured 50-kn winds with 25-ft seas. Two ships near 38°N, 138°W, had swells approaching 40 ft. Buoy 46006 read out 30-ft waves. At 1200 the pressure reached 950 mb. Buoy 46006 measured waves of 39 ft at 1000, and buoy 46002 measured 35-ft waves at 1500. Thirty-foot waves were recorded 700 mi south of the center. At 1800 the ASIA MORALITY (46°N, 163°W) and a ship near 47°N, 133°W, both had winds over 60 kn--66 and 68 kn, respectively. Another near 52°N, 133°W, had 31-ft swells. On the 23d a frontal wave moved in the southern part of the circulation and weakened the strong winds in that area. There were still winds over 40 kn and waves over 20 ft. On the 25th what was left of the storm crossed into Alaska near Valdez.

A LOW moved out of Manchuria and into the Sea of Okhotsk. As it crossed the Kamchatka Peninsula, it split into two centers. This storm started with the center that remained over the Sea. It crossed the peninsula early on the 26th. At 0000 on the 27th the 988-mb LOW was near 57°N, 173°E. The PRESIDENT JOHNSON (53°N, 171°E) had 47-kn westerly winds at 0600. On the 28th a ship had 45-kn winds and 23-ft waves. On the 29th another LOW was approaching from the west, and this one disappeared.

This LOW came out of Manchuria and crossed into the Sea of Japan on the 27th. At 1200 it was 990 mb over the Okhotsk Basin. A U.S.S.R. vessel reported 45-kn winds south of Ostrov Kunashir. Six hours later another ship north of the Island found 45 kn and 20-ft seas. On the 28th the KARSHOIE MORE had 56-kn southwesterlies at 0000 near 49°N, 152°E, with 23-ft seas. At 0600 the seas were 33 ft. On the 29th a sistership, the OKHOTSKOYE MORE, was north of the storm with 48-kn easterlies. The HAKUZAN MARU (50°N, 165°E) had 50-kn winds and 28-ft waves. In the southeast quadrant a ship had 20-ft waves, and one far to the south had 23-ft swells. The storm was tracking north of and parallel to the Aleutians. The fishing vessel BLACK HAWK (60°N, 152°W) had winds up to 55 kn. Later in the day and into the 30th the ALL ALASKAN sailing southeastward reported winds gusting to 70 kn south of Kodiak. As the storm crossed the Alaska coast south of Bethel, it weakened and was no longer significant as it entered the Beaufort Sea.

Tropical Cyclones, Eastern Pacific--Tropical storm Hilda began as a disturbance 200 mi south of the Guatemalan coast on October 1. Moving westward, the disturbance began to intensify and was upgraded to a tropical depression near 13°N, 104°W, at 0000 on the 4th. Tuna fishing boats were helpful in locating the center. The depression continued to intensify. The tanker ACILA helped to locate the center near 13.8°N,

108°W, at 1800. The depression then turned west-northwest. Tropical storm Hilda was christened near 14.6°N, 110.4°W, at 0600 on the 5th as winds increased to 40 kn. Shifting westward again, Hilda passed 250 mi south of Socorro Island at 0900. By 0000 on the 6th her winds had decreased to 30 kn, and the storm was downgraded to a depression near 15.1°N, 114.2°W, and dissipated near 15.8°N, 118°W.

Hurricane Ignacio began as a depression near 11.7°N, 95.3°W, at 1800 on the 23d. Winds near his center increased to 35 kn the following day, and he was upgraded to a tropical storm near 11.5°N, 97.9°W. On the 25th the storm was 300 mi south of Acapulco. It then turned toward the northwest and, moving at 9 kn, began to intensify rapidly over progressively warmer water. By late on the 26th winds had increased to 70 kn over 87°F water, and the storm was upgraded to a hurricane near 15.3°N, 104.3°W. On the 27th Ignacio turned westward and continued to intensify. At 1742 U.S. Air Force reconnaissance aircraft located the center of Ignacio near 17°N, 107.3°W. Winds near the center of the cyclone had reached their maximum intensity of 125 kn. The hurricane eye was reported with a well-defined closed wall 20 mi in diameter. Surface pressure was estimated at 938 mb. Reconnaissance aircraft made a second and third penetration. Surface pressure was estimated at 937 mb, and the eye was reported covered with low, broken clouds. Between 1800 on the 27th and 0000 on the 28th, several ships--the BODENA, LUTSK, PIONEER COMMANDER, and VERRANZANO BRIDGE--were helpful in locating the center of Ignacio.

Early on the 28th Ignacio turned northward and, slowing to 4 kn, began to weaken. At 1755 reconnaissance aircraft reported surface pressure at 969 mb and the eye, filled with low clouds, had decreased to a diameter of 5 mi. On the 29th Ignacio, generating 80-kn winds, turned eastward and continued to weaken. Winds near the center of the cyclone diminished to 55 kn by 1800. By 0000 on the 30th tropical storm Ignacio had moved to 75 mi southwest of Manzanillo, Mexico. Accelerating to 13 kn, he moved rapidly eastward toward the Mexican coast, making landfall 140 mi east-southeast of Manzanillo and 170 mi west-northwest of Acapulco. Remnants of Ignacio drifted across southern Mexico, dissipating over the Yucatan Peninsula on the 31st.

Tropical Cyclones, Western Pacific--Tropical storm Roger was a short-lived system. He was first spotted on the 3d about 300 mi west-northwest of Guam. Moving northwestward, he attained tropical-storm strength on the 4th after crossing the 20th parallel near 136°E. Maximum winds climbed to 45 kn as Roger accelerated north-northeastward. However, he never got beyond this intensity and began to turn extratropical on the 6th. But Roger did generate heavy rains and storm tides in the Tokyo area.

Meanwhile, typhoons Sarah and Tip were coming to life. Sarah developed in the South China Sea just west of Manila Bay on the 4th, while Tip sprung up the following day about 180 mi southwest of Truk.

While developing, Sarah caused problems in the Philippines. Torrential rains triggered flooding in the central sections where five children and a woman drowned. Meandering southward, Sarah reached typhoon strength on the 7th before moving across Palawan where she caused havoc. Taytay was severely damaged. Earlier the EVERWISE ran aground on Saddle Rock near Culion Island. Sarah's winds climbed to 90 kn as she swung west-northwestward on the 9th. She maintained this intensity until the 12th, when winds started to drop. By the time Sarah reached the coast of Vietnam on the 14th she was a tropical storm. Sarah moved inland near Qui Nhon.

Meanwhile, Tip was developing into the blockbuster storm of the year. After passing Truk on the 8th and Guam early the following day as a tropical storm, Tip reached typhoon strength late on the 9th. Heading west-northwestward winds jumped to 110 kn early on the 11th and to 135 kn 24 hr later. It was on the 12th that a reconnaissance aircraft reported a dropsonde pressure of 870 mb--the lowest ever measured in a tropical cyclone. Even though ships were giving a wide berth to Tip, they were still encountering gale-force winds in 25-ft swells 200 to 300 mi from the storm's center. Among these ships were the IBARAKI MARU and the SHINNICHI MARU. Maximum estimated winds remained above 100 kn into the 16th. By this time Tip was beginning to recurve northeastward. Though passing 400 mi to the northeast of Luzon, the typhoon dumped heavy rains over the northern Philippines. To the north Kyushu and Okinawa were already being pounded by 25-ft waves. Although winds were dropping Tip was still a powerful storm as he moved up the Ryukyus and over Honshu on the 18th and 19th. Many American ships became involved in Tip. The IRIS ISLAND and POLAR ALASKA both measured 65-kn winds under the influence of Tip. The ALLTRANS EXPRESS took the wave honors with 43 ft.

Ships grounded or sunk by Tip include the SHINEI MARU No. 11, YOO YEO No. 25, DONG WON No. 61, CHIL BO SAN No. 1, and the GELATIK. The GOLDEN VALLEY collided with the WORLD HERCULES. The YING SHAN went aground off Cape Erimo, Hokkaido, and was then broken in two by mountainous seas. The 6,938-ton JELAU broke a propeller shaft on the 14th, listed heavily on the 16th, and was abandoned by the crew, which was rescued. An air search failed to locate the vessel; but floating logs, which were the cargo, were found. Overall at least 44 fishermen were dead or missing in various incidents off Hokkaido. Onshore the typhoon also raised havoc. More than 22,000 homes were flooded, and there were more than 600 landslides. A fuel tank fire, triggered by Tip, washed away the tank supports and killed two and injured 42 American marines at a joint U.S.-Japanese military training center at the base of Mt. Fuji. Throughout Japan a total of 42 people died, 71 were missing, and 283 injured.

Casualties--The 44,875-ton American BEAVER STATE requested heavy weather damage survey on the 21st at Kagoshima that occurred earlier in the month. The ZIM SYDNEY enroute to Hong Kong on the 9th found heavy weather. The 6,720-ton Pakistani SAFINA-E-HAIDER was at Mojii on the 12th with heavy weather damage. The 16,371-ton JAPAN ERICA knocked out a span of the Canadian National Railways Bridge over the Second Narrows in heavy fog on the 12th.

The 10,186-ton Indian APJ PRITI reported heavy weather damage at Chiba. The 32,713-ton Liberian HONSHU GLORIA sustained heavy weather on the 19th

Continued on page 139.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

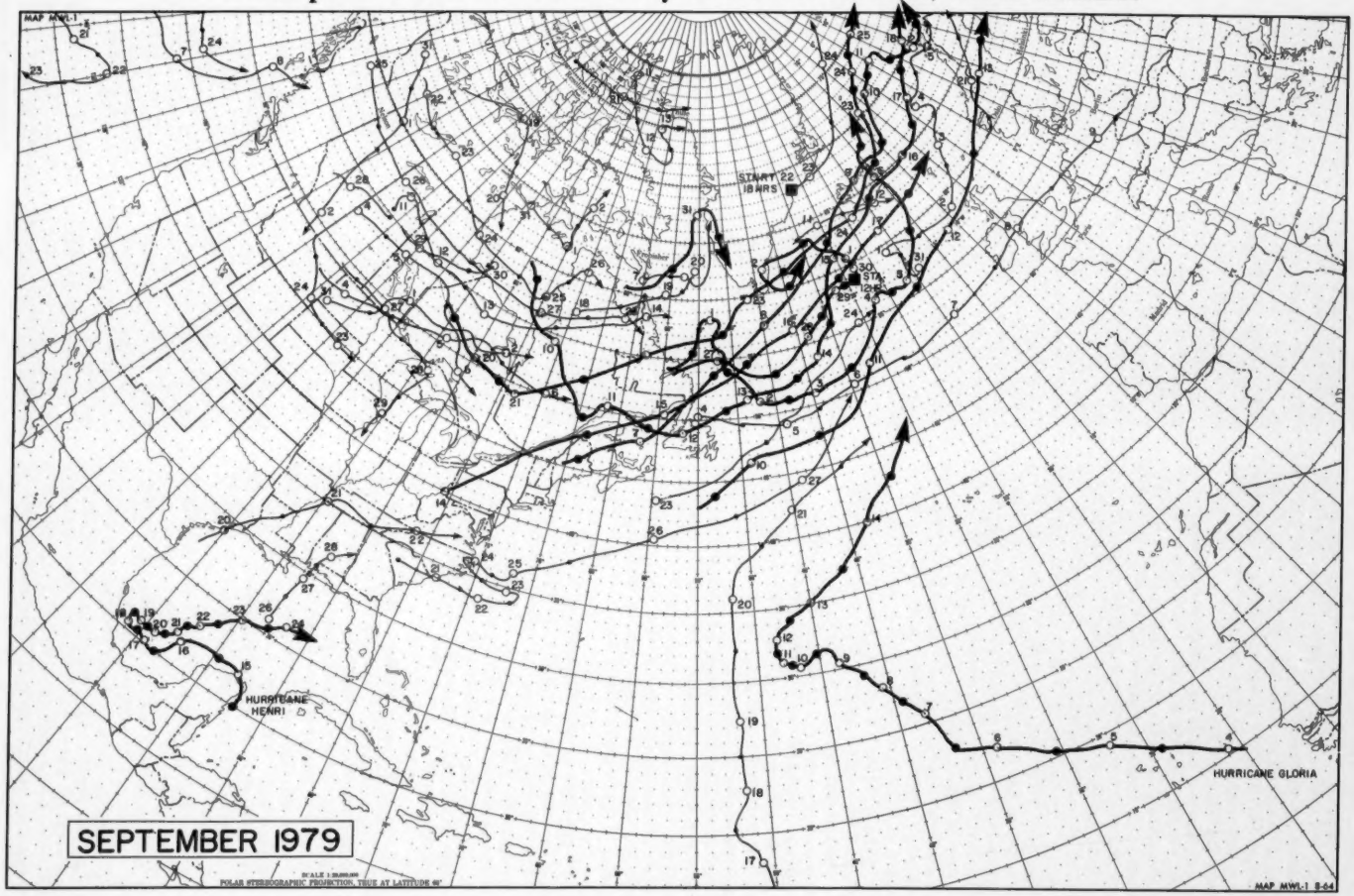


Figure 38.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

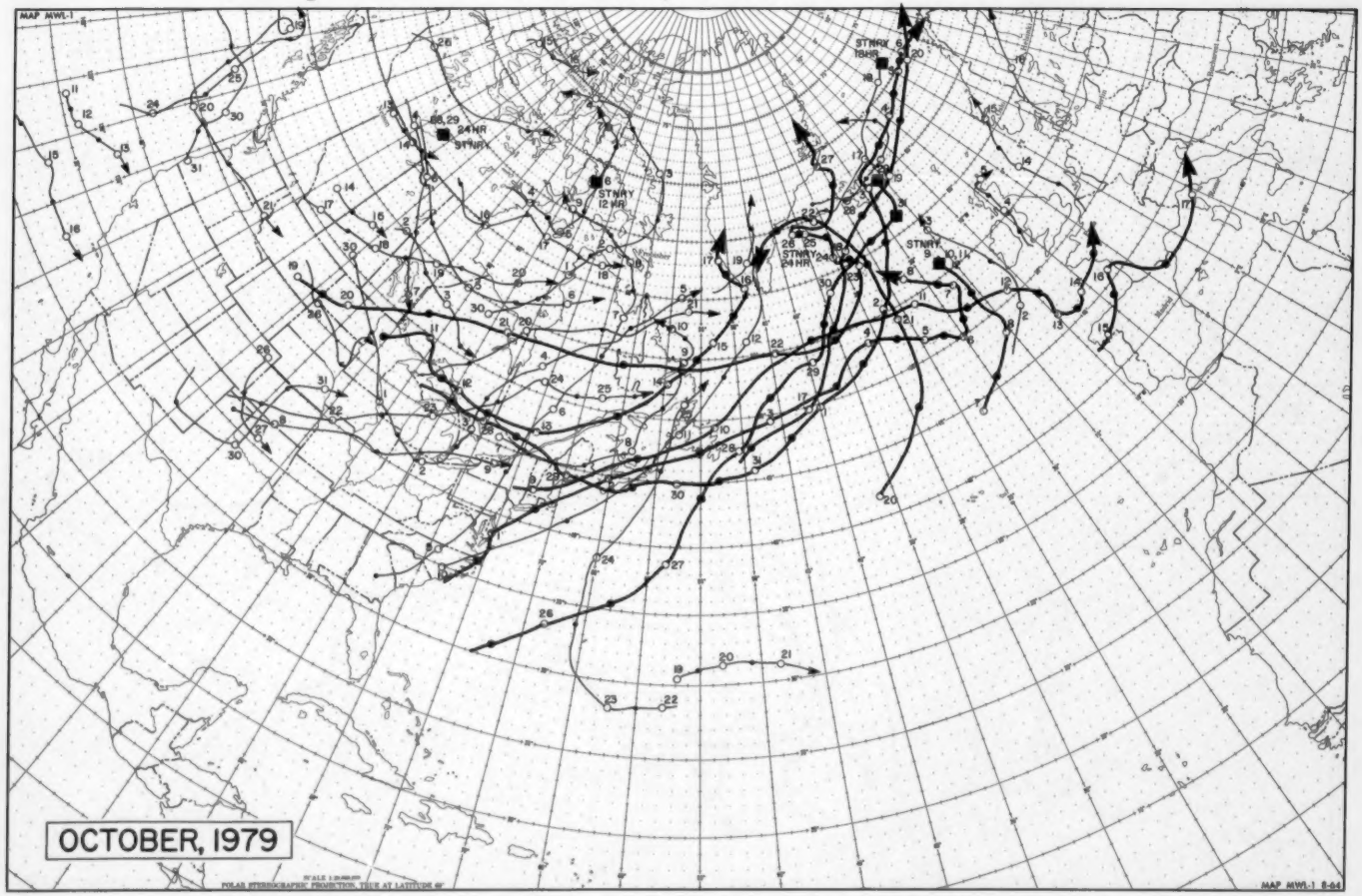


Figure 39. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

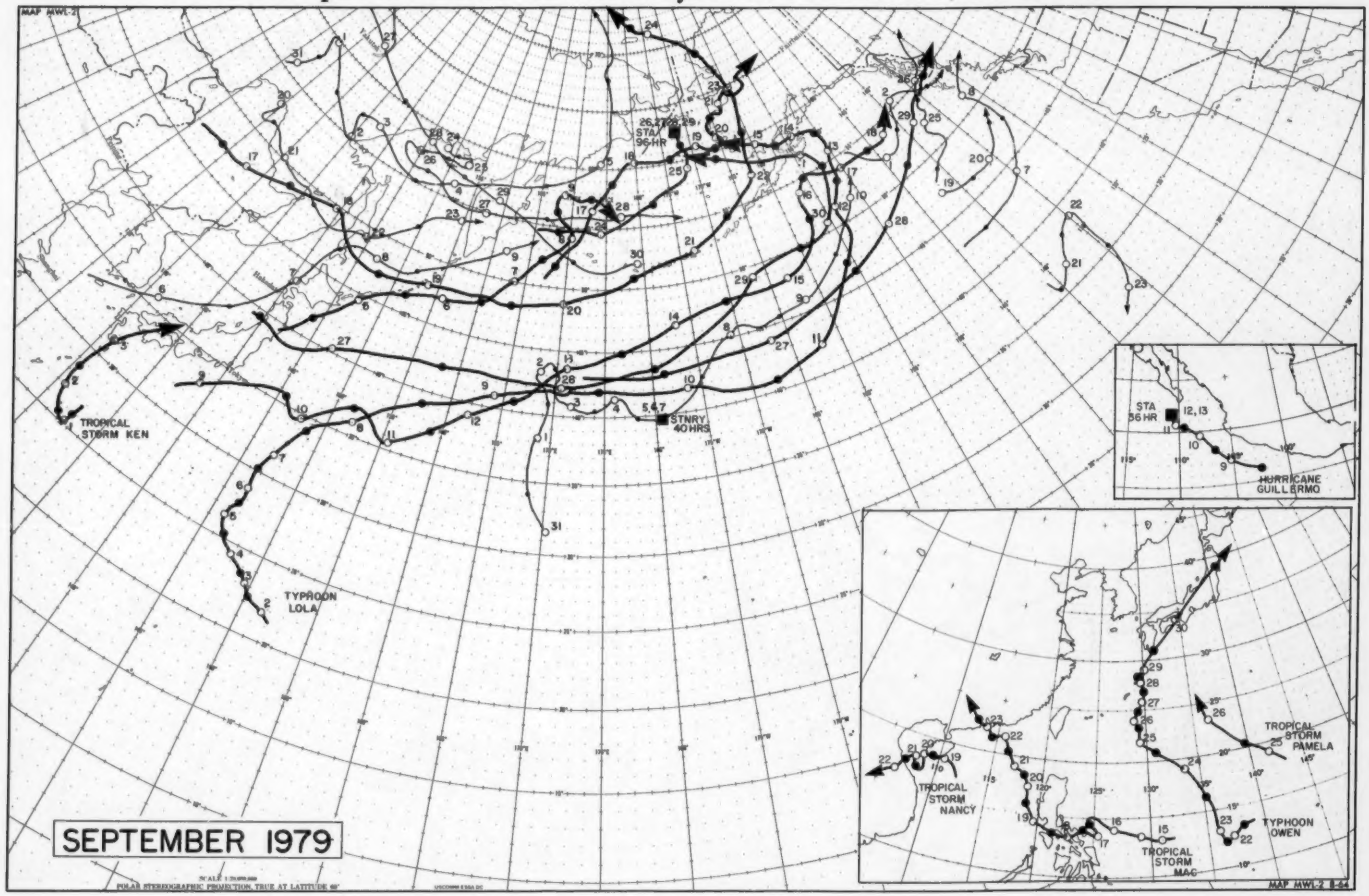


Figure 40.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

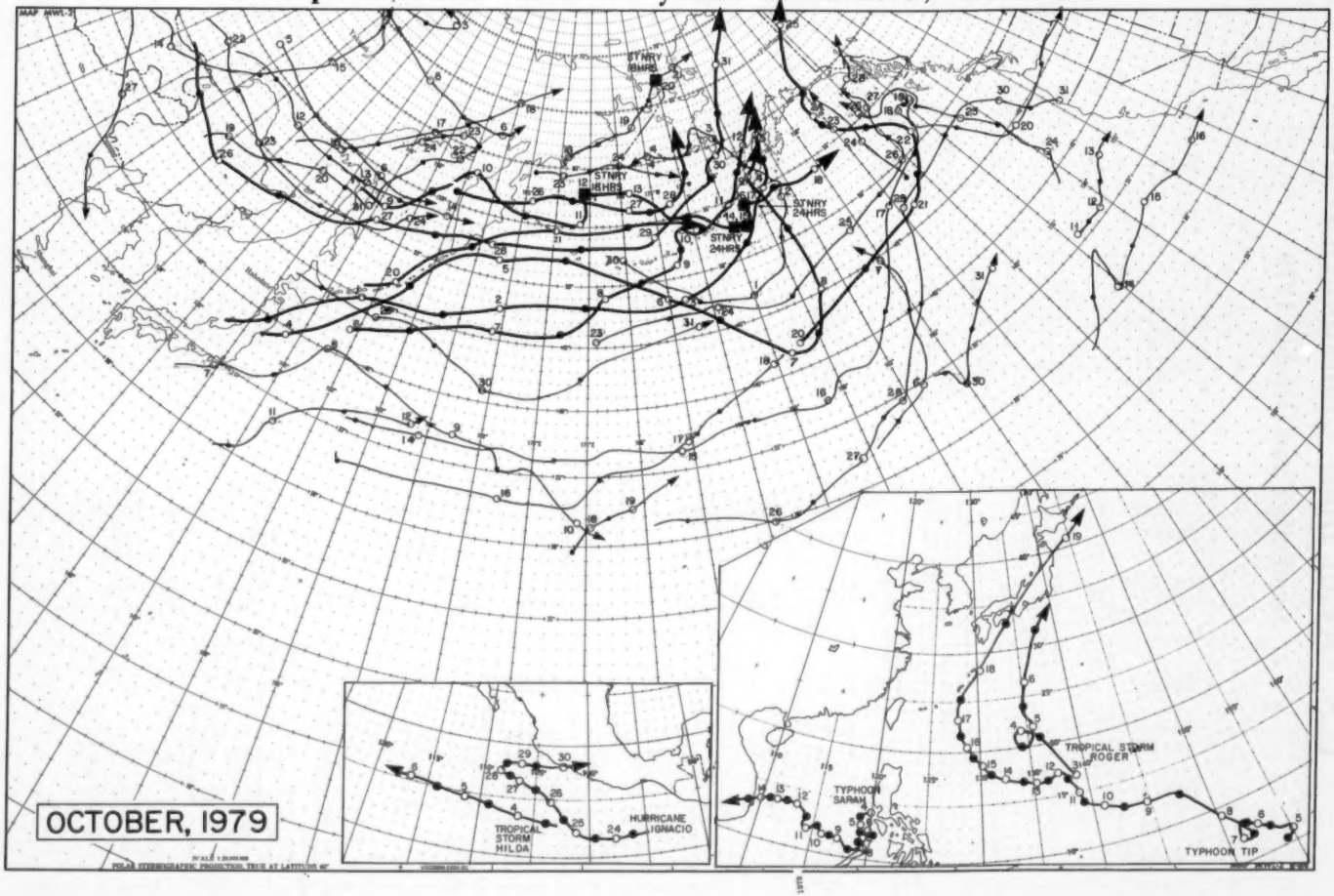


Figure 41.--Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

September and October 1979

SEPTEMBER DATA SUMMARY 41001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.3	(28 12)	25.6	26.4	(30 18)	26	4
SEA TEMP (DEG C)	25.4	(26 12)	26.0	27.0	(30 21)	26	4
AIR-SEA TEMP (DEG C)	-01.1	(28 15)	-00.4	00.4	(28 21)	26	4
PRESSURE (MBAR)	1013.4	(30 21)	1017.5	1019.9	(28 03)	26	4

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N								
NE		3.8	15.4				19.2	12.4
E			11.5				11.5	15.4
SE		23.1	11.5				34.6	9.0
S		19.2	15.4				34.6	10.3
SW								
W								
NW								
CALM								
TOTAL		46.2	53.8				100.0	10.9

NO. OF OBS: 26

MAX WIND
SPEED: 16 KNOTS
DIRECTION: 070 DEG
DAY: 27
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 26

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	7.7	92.3							1.1M	1.5M	(28 15)

SEPTEMBER DATA SUMMARY 41002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.8	(18 15)	26.5	28.3	(04 18)	240	30
SEA TEMP (DEG C)	26.8	(21 12)	27.6	29.4	(26 21)	240	30
AIR-SEA TEMP (DEG C)	-03.8	(30 18)	-01.1	00.8	(05 18)	240	30
PRESSURE (MBAR)	1012.4	(08 09)	1017.5	1023.6	(17 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.3	2.9				6.3	9.8
NE		1.3					1.3	6.7
E		5.0	6.3				11.3	11.1
SE	.4	8.8	20.0	2.5			31.7	13.1
S	1.7	6.3	8.8	6.3			22.9	15.8
SW		2.1	9.2	2.5			13.8	16.3
W		2.9	3.8				6.7	11.8
NW	1.7	4.2	.4				6.3	6.0
CALM								
TOTAL	3.8	33.8	51.3	11.3			100.0	13.1

NO. OF OBS: 240

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 170 DEG
DAY: 05
HOUR: 12

SEPTEMBER DATA SUMMARY 41004
AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.9	(25 18)	25.5	28.7	(04 12)	238	30
SEA TEMP (DEG C)	24.4	(18 12)	26.2	28.7	(01 03)	238	30
AIR-SEA TEMP (DEG C)	-04.3	(04 00)	-00.8	01.2	(22 03)	238	30
PRESSURE (MBAR)	1001.0	(05 00)	1015.9	1023.9	(17 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	2.5	3.8				7.1	10.3
NE	.8	2.5	18.5	4.6			26.5	17.1
E	.8	4.6	10.5	.4			16.4	13.0
SE		9.2	6.3	1.7	.4		17.6	12.2
S		.8	6.7	5.0			12.6	20.1
SW	.4	3.4	7.6	.8			12.2	13.8
W	.8	1.7	.4				2.9	7.0
NW	.8	2.1	.4				3.4	6.8
CALM	1.3						1.3	.0
TOTAL	5.9	26.9	54.2	12.6	.4		100.0	14.2

NO. OF OBS: 238

MAX WIND
SPEED: 36 KNOTS
DIRECTION: 140 DEG
DAY: 06
HOUR: 00

SEPTEMBER DATA SUMMARY 41006
AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.3	(24 12)	25.7	28.3	(02 21)	228	30
SEA TEMP (DEG C)	23.6	(06 00)	26.4	29.1	(01 03)	228	30
AIR-SEA TEMP (DEG C)	-04.1	(24 12)	-00.8	01.9	(04 21)	228	30
PRESSURE (MBAR)	0995.6	(04 18)	1014.3	1022.4	(17 15)	231	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	1.7	.4				3.0	5.3
NE		4.8	13.9	6.1			24.8	17.3
E	.9	3.5	11.3	2.6			18.3	16.1
SE		4.8	5.7	.4	.4		11.3	14.2
S	.9	1.7	10.4	2.6	1.3		17.0	17.2
SW	.4	2.6	9.6	2.6			15.2	15.2
W	1.3	.4	.4				2.2	5.0
NW	1.7	3.5	.4				5.7	6.0
CALM	2.6						2.6	.0
TOTAL	8.7	23.0	52.2	16.3	1.7		100.0	14.7

NO. OF OBS: 230

MAX WIND
SPEED: 40 KNOTS
DIRECTION: 170 DEG
DAY: 04
HOUR: 18

OCTOBER DATA SUMMARY 41001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.2	(25 03)	23.1	26.8	(03 18)	101	14
SEA TEMP (DEG C)	23.8	(25 09)	25.2	26.7	(01 00)	101	14
AIR-SEA TEMP (DEG C)	-07.0	(15 18)	-02.0	00.5	(03 15)	101	14
PRESSURE (MBAR)	1004.9	(24 18)	1018.4	1025.3	(21 15)	101	14

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.0	1.0					2.0	6.6
NE		5.9	12.9				18.8	11.1
E	2.0	15.8	7.9				25.7	9.2
SE	1.0	5.0	1.0				6.9	7.7
S	4.0		11.9	2.0			17.8	13.8
SW	3.0	4.0	7.9	2.0			16.8	11.7
W	2.0	2.0	2.0				5.9	8.7
NW		1.0	4.0	1.0			5.9	14.8
CALM								
TOTAL	12.9	34.7	47.5	5.0			100.0	11.0

NO. OF OBS: 101

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 210 DEG
DAY: 03
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 46

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	17.4	58.7	23.9						1.3M	2.5M	(03 18)

OCTOBER DATA SUMMARY 41002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.2	(27 12)	23.6	27.4	(03 18)	247	31
SEA TEMP (DEG C)	25.1	(31 09)	26.4	27.9	(02 21)	247	31
AIR-SEA TEMP (DEG C)	-08.3	(27 12)	-02.8	00.0	(03 18)	247	31
PRESSURE (MBAR)	1008.7	(24 12)	1017.6	1024.7	(15 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	3.6	7.7	.8			13.8	12.2
NE	.4	2.4	2.4				5.3	10.9
E	1.2	4.0	26.7	.8			32.8	14.2
SE		3.2	.4				3.6	7.4
S	.8	2.0	3.2				6.1	11.0
SW	.8	5.3	13.8	1.2			21.1	14.2
W	1.2	2.8	6.1	.8			10.9	12.8
NW	.8	1.6	3.2	.4			6.1	11.7
CALM	.4						.4	.0
TOTAL	7.3	25.1	63.6	4.0			100.0	13.0

NO. OF OBS: 247

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 240 DEG
DAY: 05
HOUR: 15

OCTOBER DATA SUMMARY 41004
AVERAGE LATITUDE 32.6N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.6	(14 15)	22.4	26.8	(03 06)	246	31
SEA TEMP (DEG C)	22.8	(14 21)	24.5	26.0	(01 21)	246	31
AIR-SEA TEMP (DEG C)	-08.4	(14 15)	-02.2	01.3	(19 15)	246	31
PRESSURE (MBAR)	1008.3	(05 09)	1016.6	1024.6	(15 15)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	1.2	6.9	1.2			11.0	13.7
NE	.4	1.6	11.4				13.4	14.2
E	.4	10.2	13.4	1.2			25.2	12.1
SE	.4	2.0	2.0				4.5	9.2
S	1.2	1.6	2.4	.8			6.1	12.2
SW	.8	5.7	10.6	.4			17.5	12.5
W	.8	4.5	8.1	3.3			16.7	14.2
NW	.8	2.0	2.4				5.3	9.5
CALM	.4						.4	.0
TOTAL	6.9	28.9	57.3	6.9			100.0	12.7

NO. OF OBS: 246

MAX WIND
SPEED: 28 KNOTS
DIRECTION: 010 DEG
DAY: 14
HOUR: 08

OCTOBER DATA SUMMARY 41006
AVERAGE LATITUDE 31.7N AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.0	(14 18)	23.0	26.2	(05 03)	235	31
SEA TEMP (DEG C)	24.2	(28 12)	26.0	27.9	(06 09)	235	31
AIR-SEA TEMP (DEG C)	-09.4	(14 12)	-03.0	00.7	(20 06)	235	31
PRESSURE (MBAR)	1008.4	(05 09)	1016.2	1022.6	(15 15)	236	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

SPEED (KNOTS) DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.7	4.7	5.1	.4			11.9	10.6
NE	.8	3.4	11.0	2.1			17.4	15.1
E	1.3	3.0	12.7	2.5			19.5	13.9
SE	.4	2.1	5.5	.4			8.5	13.0
S	.4	4.7	1.7				6.8	9.0
SW	.8	3.8	7.6	.4			12.7	11.8
W	3.0	3.0	8.1	.8			14.8	11.7
NW	.4	1.3	2.5	1.7			5.9	14.9
CALM	2.5						2.5	.0
TOTAL	11.4	25.8	54.2	8.5			100.0	12.4

NO. OF OBS: 236

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 020 DEG
DAY: 14
HOUR: 09

SEPTEMBER DATA SUMMARY 42002
AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.0	(07 18)	27.1	29.6	(02 18)	238	30
SEA TEMP (DEG C)	27.2	(30 15)	28.4	30.4	(05 21)	238	30
AIR-SEA TEMP (DEG C)	-03.9	(07 18)	-01.4	00.2	(19 15)	238	30
PRESSURE (MBAR)	1003.3	(13 00)	1010.6	1017.2	(30 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N		7.6	3.8				11.3	9.8
NE	1.7	4.2	24.4	9.2			39.5	16.5
E	.8	5.9	11.8	2.5			21.0	12.6
SE	1.7	6.7	3.8	3.8			16.0	13.0
S	.4	2.5	5.9	.8			9.7	12.5
SW			.4				.4	17.0
W	.8		.4				1.3	6.3
NW			.4				.4	11.0
CALM	.4						.4	.0
TOTAL	5.9	26.9	50.8	16.4			100.0	13.8

NO. OF OBS: 238
MAX WIND
SPEED: 31 KNOTS
DIRECTION: 050 DEG
DAY: 16
HOUR: 06

OCTOBER DATA SUMMARY 42002
AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.4	(24 03)	25.4	27.5	(22 18)	246	31
SEA TEMP (DEG C)	25.4	(26 09)	27.1	28.4	(07 21)	246	31
AIR-SEA TEMP (DEG C)	-05.2	(24 03)	-01.7	00.6	(30 21)	246	31
PRESSURE (MBAR)	1002.9	(30 21)	1014.1	1018.4	(04 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N	1.2	2.8	2.0	.8			6.9	11.3
NE	.8	2.4	8.5	.8			12.6	13.7
E	2.4	9.3	12.6				24.3	10.5
SE	3.6	10.5	6.5				20.6	9.1
S	1.2	10.5	9.7	2.8			24.3	11.9
SW	.8	2.4	1.6				4.9	7.4
W	.8	.8					1.6	3.3
NW	1.2	1.6	.8				3.6	7.3
CALM	1.2						1.2	.0
TOTAL	13.4	40.5	41.7	4.5			100.0	10.5

NO. OF OBS: 247
MAX WIND
SPEED: 20 KNOTS
DIRECTION: 170 DEG
DAY: 31
HOUR: 03

SEPTEMBER DATA SUMMARY 42003
AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.0	(23 21)	27.5	29.4	(00 18)	124	30
SEA TEMP (DEG C)	26.3	(24 12)	28.4	29.9	(08 18)	124	30
AIR-SEA TEMP (DEG C)	-03.7	(11 15)	-00.9	00.8	(17 06)	124	30
PRESSURE (MBAR)	0961.8	(12 03)	1010.5	1016.1	(25 15)	124	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N	1.6	.8	4.8				7.3	10.2
NE		2.4	10.5	1.6	.8	.8	16.1	18.6
E	.8	7.3	19.4		.8		28.2	13.2
SE	2.4	11.3	3.2				16.9	8.0
S	.8	4.8	12.9	2.4	.8	.8	22.6	16.7
SW		1.6	1.6				3.2	11.8
W	.8	1.6					2.4	6.7
NW		2.4		.8			3.2	12.5
CALM								
TOTAL	6.5	32.3	52.4	4.8	2.4	1.6	100.0	13.5

NO. OF OBS: 124
MAX WIND
SPEED: 66 KNOTS
DIRECTION: 030 DEG
DAY: 12
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 126

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	31.0	50.0	7.9	2.4	5.6	2.4	.8		1.4M	9.0M	(12 00)

OCTOBER DATA SUMMARY 42003
AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 086.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.5	(26 06)	26.7	28.7	(03 18)	51	28
SEA TEMP (DEG C)	26.2	(30 18)	27.0	28.2	(04 18)	51	28
AIR-SEA TEMP (DEG C)	-04.0	(26 06)	-01.3	00.6	(03 10)	51	28
PRESSURE (MBAR)	1012.5	(24 06)	1015.6	1018.8	(07 18)	51	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N		5.9	5.9				11.8	12.0
NE	2.0	5.9	17.6	2.0			27.5	13.6
E	3.9	15.7	25.5				45.1	11.2
SE			3.9				3.9	13.5
S		2.0					2.0	9.1
SW	2.0	2.0					3.9	5.0
W		2.0					2.0	8.0
NW	2.0						2.0	3.0
CALM	2.0						2.0	.0
TOTAL	11.8	33.3	52.9	2.0			100.0	11.3

NO. OF OBS: 51
MAX WIND
SPEED: 22 KNOTS
DIRECTION: 050 DEG
DAY: 05
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 51

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	33.3	58.8	7.8						1.1M	2.5M	(15 18)

SEPTEMBER DATA SUMMARY 42005
AVERAGE LATITUDE 30.0N AVERAGE LONGITUDE 089.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	19.9	(25 09)	26.0	30.9	(03 21)	240	30
SEA TEMP (DEG C)	26.2	(28 15)	28.2	30.6	(07 18)	240	30
AIR-SEA TEMP (DEG C)	-06.8	(25 09)	-02.2	01.3	(19 21)	240	30
PRESSURE (MBAR)	0999.6	(13 00)	1012.3	1019.1	(17 15)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N	1.3	4.2	11.7	.4			17.5	12.9
NE	.4	2.5	17.1	11.3			31.3	18.8
E		2.9	9.6	2.5	.4		15.4	16.2
SE	.8	2.9	4.2	1.7			9.6	13.0
S	.4		2.1	2.1			4.6	18.9
SW	.4	2.1	5.0				7.5	12.1
W	.8	3.8	2.9				7.5	9.9
NW	.4	1.7	3.3				5.4	11.3
CALM	1.3						1.3	.0
TOTAL	5.8	20.0	55.8	17.9	.4		100.0	15.1

NO. OF OBS: 240
MAX WIND
SPEED: 35 KNOTS
DIRECTION: 090 DEG
DAY: 12
HOUR: 21

OCTOBER DATA SUMMARY 42005
AVERAGE LATITUDE 30.0N AVERAGE LONGITUDE 089.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.9	(24 12)	22.4	26.9	(02 18)	247	31
SEA TEMP (DEG C)	23.2	(31 12)	25.1	27.0	(01 21)	247	31
AIR-SEA TEMP (DEG C)	-10.3	(24 12)	-02.6	00.6	(30 21)	247	31
PRESSURE (MBAR)	1009.9	(02 21)	1015.7	1021.6	(15 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N	2.0	1.6	9.7	3.2			16.6	15.1
NE	.8	4.0	11.7	.8			17.4	13.4
E		6.9	13.8	.8			21.5	12.8
SE		4.5	5.7				10.5	11.9
S	.4	4.5	2.4				7.3	9.4
SW		3.6	6.1	.4			10.1	13.1
W	.8	3.6	4.9	1.2			10.5	12.1
NW	.4	3.6	1.6				5.7	10.4
CALM	.4						.4	.0
TOTAL	4.9	32.8	55.9	6.5			100.0	12.7

NO. OF OBS: 247
MAX WIND
SPEED: 27 KNOTS
DIRECTION: 350 DEG
DAY: 24
HOUR: 06

SEPTEMBER DATA SUMMARY 42006
AVERAGE LATITUDE 26.5N AVERAGE LONGITUDE 096.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.3	(03 15)	26.6	28.9	(06 21)	240	30
SEA TEMP (DEG C)	25.7	(28 12)	28.1	29.4	(01 00)	240	30
AIR-SEA TEMP (DEG C)	-06.3	(03 15)	-01.4	00.9	(28 15)	240	30
PRESSURE (MBAR)	1004.3	(20 09)	1011.5	1018.4	(25 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N	.4	1.7	8.3	8.7	3.1		22.3	22.8
NE		1.3	14.0	12.2	4.8		32.3	23.1
E		3.1	7.9	3.9	.4		15.3	17.5
SE	.9	2.6	4.4	1.7			9.6	14.2
S	.9	3.9	3.9	2.2			10.9	13.2
SW		.4	1.7	1.3			3.5	19.5
W	1.3	.4	.4	.4			2.6	9.4
NW			.9	2.6			3.5	22.1
CALM								
TOTAL	3.5	13.5	41.5	33.2	8.3		100.0	19.7

NO. OF OBS: 229
MAX WIND
SPEED: 40 KNOTS
DIRECTION: 040 DEG
DAY: 15
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 239

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	19.2	48.1	21.3	11.3					1.0M	3.5M	(18 21)

OCTOBER DATA SUMMARY 42006
AVERAGE LATITUDE 26.5N AVERAGE LONGITUDE 096.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.0	(24 00)	25.3	27.6	(21 21)	247	31
SEA TEMP (DEG C)	25.6	(27 15)	26.9	28.4	(01 21)	247	31
AIR-SEA TEMP (DEG C)	-05.9	(23 21)	-01.2	00.9	(30 21)	247	31
PRESSURE (MBAR)	0999.1	(31 00)	1013.7	1020.3	(23 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						MEAN	
DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	SPEED (KNOTS)
N		2.0	9.7	4.5	.4		12.6	19.5
NE		4.9	.8				5.7	7.9
E	.8	9.7	4.9				15.4	8.4
SE	.8	14.2	14.2	.8			30.0	11.1
S	1.2	6.5	18.2	5.3			31.2	14.9
SW		.8	1.6	.8			3.2	13.9
W		.8					.8	4.6
NW	.4	.4	.4				1.2	8.7
CALM								
TOTAL	3.2	39.3	45.7	11.3	.4		100.0	12.7

NO. OF OBS: 247
MAX WIND
SPEED: 34 KNOTS
DIRECTION: 010 DEG
DAY: 10
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	10.8	48.1	8.8	5.0	1.3				1.3M	4.0M	(31 00)

SEPTEMBER DATA SUMMARY 44001
AVERAGE LATITUDE 38.7N AVERAGE LONGITUDE 073.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.2	(20 12)	21.1	26.0	(06 09)	239	30
SEA TEMP (DEG C)	18.3	(25 12)	21.4	25.1	(04 21)	239	30
AIR-SEA TEMP (DEG C)	-05.8	(20 12)	-00.3	03.2	(14 18)	239	30
PRESSURE (MBAR)	1004.1	(06 12)	1017.9	1027.3	(17 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4 10	21	33	47 >47			
N	4.2	5.0	.8		10.0	12.7	MAX WIND
NE	.4	5.0	5.4	2.1	13.0	14.5	SPEED: 34 KNOTS
E		9.6	10.5	3.3	23.4	13.6	DIRECTION: 190 DEG
SE	1.7	3.8	3.3		8.8	9.3	DAY: 06
S	1.3	8.8	6.3	1.3 .4	18.0	11.5	HOUR: 09
SW	.4	2.1	6.3	1.3	10.0	14.3	
W	1.3	7.5	3.8		12.6	8.3	
NW	.4	1.7			2.1	7.0	
CALM	2.1				2.1	.0	
TOTAL	7.5	42.7	40.6	8.8 .4	100.0	11.9	

OCTOBER DATA SUMMARY 44001
AVERAGE LATITUDE 38.7N AVERAGE LONGITUDE 073.6W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.8	(26 12)	16.0	22.2	(01 15)	204	26
SEA TEMP (DEG C)	15.3	(26 12)	17.3	21.6	(01 18)	204	26
AIR-SEA TEMP (DEG C)	-07.8	(10 21)	-01.2	03.1	(03 15)	204	26
PRESSURE (MBAR)	1000.8	(07 18)	1014.4	1025.9	(19 15)	204	26

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 204
DIR	<4 10	21	33	47 >47			
N	1.0 .5	6.9	2.0		10.3	16.0	MAX WIND
NE	1.0	4.4	1.5	2.0	8.8	11.8	SPEED: 30 KNOTS
E	3.9	3.4	.5	.5	8.3	5.8	DIRECTION: 290 DEG
SE	.5	1.0	.5		2.0	7.5	DAY: 06
S	1.5	5.9	6.9	.5	14.7	9.8	HOUR: 03
SW	1.5	6.4	10.8	3.9	22.5	14.2	
W	1.0	1.5	9.8	1.0	13.2	14.2	
NW		1.0	8.8	7.4	17.2	18.8	
CALM	2.9				2.9	.0	
TOTAL	13.2	24.0	45.6	17.2	100.0	13.1	

SEPTEMBER DATA SUMMARY 44002
AVERAGE LATITUDE 40.1N AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.3	(20 09)	19.6	24.4	(06 12)	237	30
SEA TEMP (DEG C)	17.5	(26 09)	20.1	23.6	(05 18)	237	30
AIR-SEA TEMP (DEG C)	-08.4	(20 09)	-00.5	03.0	(14 18)	237	30
PRESSURE (MBAR)	1000.3	(06 18)	1018.0	1026.9	(24 15)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 239
DIR	<4 10	21	33	47 >47			
N	.4 2.5	3.3	.4		6.7	10.8	MAX WIND
NE	4.2	7.5	2.1		13.8	13.8	SPEED: 29 KNOTS
E	1.7 5.0	9.2	.4		16.3	12.5	DIRECTION: 230 DEG
SE	.4 7.1	1.7			9.2	7.7	DAY: 06
S	1.7 7.1	6.7	.8		16.3	11.1	HOUR: 18
SW	1.7 2.9	9.2	1.3		15.1	12.5	
W	2.1 6.7	6.7	.4		15.9	9.2	
NW	.8 2.5	2.9			6.3	11.5	
CALM	.4				.4	.0	
TOTAL	9.2 38.1	47.3	5.4		100.0	11.3	

OCTOBER DATA SUMMARY 44002
AVERAGE LATITUDE 40.1N AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.7	(27 12)	14.0	20.2	(02 21)	247	31
SEA TEMP (DEG C)	14.2	(31 03)	16.2	19.3	(02 21)	247	31
AIR-SEA TEMP (DEG C)	-10.4	(10 18)	-02.2	02.1	(03 18)	247	31
PRESSURE (MBAR)	0998.4	(07 21)	1014.9	1032.9	(31 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 247
DIR	<4 10	21	33	47 >47			
N	3.2	7.7	.4		11.3	12.9	MAX WIND
NE	2.4	3.6	.4		6.5	12.8	SPEED: 32 KNOTS
E	1.6	2.4			4.0	12.1	DIRECTION: 260 DEG
SE	.8 4.5	3.2			8.5	9.3	DAY: 06
S	.4 4.5	5.3			10.1	10.8	HOUR: 03
SW	1.2 4.5	13.4	1.2		20.2	13.3	
W	.8 3.2	11.7	4.0		19.8	15.8	
NW	2.0	11.7	4.0		17.8	16.9	
CALM	1.6				1.6	.0	
TOTAL	4.9 25.9	59.1	10.1		100.0	13.5	

SEPTEMBER DATA SUMMARY 44003
AVERAGE LATITUDE 40.8N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.8	(20 09)	15.9	21.3	(06 18)	194	25
SEA TEMP (DEG C)	13.5	(10 06)	14.8	17.4	(19 15)	194	25
AIR-SEA TEMP (DEG C)	-04.6	(20 15)	-01.1	06.1	(15 03)	194	25
PRESSURE (MBAR)	1002.6	(07 03)	1018.7	1027.9	(24 15)	194	25

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 194
DIR	<4 10	21	33	47 >47			
N	3.1 11.9	5.7			20.6	8.1	MAX WIND
NE	2.1 3.6	9.8			15.5	13.5	SPEED: 24 KNOTS
E	2.1 4.6				6.7	5.6	DIRECTION: 330 DEG
SE	2.1				2.1	6.3	DAY: 20
S	.5 11.9	7.2	1.5		21.1	11.0	HOUR: 03
SW	1.5 8.2	2.6	.5		12.9	7.8	
W	3.6 5.2	1.0			9.8	5.6	
NW	1.5 6.2	1.0	1.5		10.3	9.9	
CALM	1.0				1.0	.0	
TOTAL	15.5 53.6	27.3	3.6		100.0	9.1	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 194

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	33.0	36.1	23.7	6.2	1.0				1.3M	4.0M	(07 03)

OCTOBER DATA SUMMARY 44003
AVERAGE LATITUDE 40.8N AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.7	(28 00)	13.4	18.9	(06 06)	247	31
SEA TEMP (DEG C)	11.7	(22 18)	14.3	15.3	(04 21)	247	31
AIR-SEA TEMP (DEG C)	-07.6	(28 00)	-01.0	04.0	(22 18)	247	31
PRESSURE (MBAR)	0998.1	(08 00)	1015.1	1030.7	(31 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 247
DIR	<4 10	21	33	47 >47			
N	.8 3.2	7.7	.4		12.1	12.2	MAX WIND
NE	.8 2.0	1.6			4.5	10.1	SPEED: 29 KNOTS
E	.8 9.3	2.8	.4		13.4	8.7	DIRECTION: 270 DEG
SE	.8 6.5	4.0			11.3	9.0	DAY: 08
S	7.3	4.5			11.7	10.2	HOUR: 15
SW	4.9	7.7	.8		13.4	12.1	
W	.4 3.2	12.6	5.3		21.5	17.1	
NW	.4 2.8	8.1	.4		11.7	13.3	
CALM	.4				.4	.0	
TOTAL	4.5 39.3	49.0	7.3		100.0	12.2	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	14.8	45.9	27.5	9.0	2.9				1.7M	5.5M	(08 15)

SEPTEMBER DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.3	(20 12)	21.8	26.0	(06 18)	232	30
SEA TEMP (DEG C)	19.9	(23 06)	22.9	24.5	(08 21)	232	30
AIR-SEA TEMP (DEG C)	-08.6	(20 12)	-01.1	02.8	(22 15)	232	30
PRESSURE (MBAR)	1006.9	(07 00)	1019.0	1027.4	(17 15)	232	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 232
DIR	<4 10	21	33	47 >47			
N	.4	3.4	11.2	3.4	18.5	15.0	MAX WIND
NE		4.7	8.6	3.0	16.4	14.7	SPEED: 30 KNOTS
E	1.3	3.4	3.9		8.6	8.5	DIRECTION: 200 DEG
SE	.4	4.3	6.0		10.8	10.8	DAY: 06
S	.9	4.7	11.2	3.4	20.3	15.0	HOUR: 21
SW	.9	2.2	4.7	.9	8.6	12.1	
W	1.3	1.3	5.2	.4	8.2	11.3	
NW	.9	3.0	5.0		6.9	9.9	
CALM	1.7				1.7	.0	
TOTAL	7.8	27.2	53.9	11.2	100.0	12.8	

OCTOBER DATA SUMMARY 44004
AVERAGE LATITUDE 39.0N AVERAGE LONGITUDE 070.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.0	(18 12)	18.9	25.1	(03 21)	127	17
SEA TEMP (DEG C)	20.1	(17 00)	22.0	24.2	(01 18)	127	17
AIR-SEA TEMP (DEG C)	-09.7	(14 12)	-03.1	01.4	(10 00)	127	17
PRESSURE (MBAR)	0999.0	(07 21)	1013.0	1024.4	(17 00)	127	17

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS) 4-	11-	22-	34-	TOTAL %	MEAN SPEED (KNOTS)	NO. OF OBS: 127
DIR	<4 10	21	33	47 >47			
N	2.4	5.5			7.9	12.7	MAX WIND
NE	1.6	1.6			3.1	10.0	SPEED: 36 KNOTS
E	1.6	.8			2.4	11.7	DIRECTION: 200 DEG
SE	.8 1.6	6.3			8.7	12.9	DAY: 08
S	6.3	4.7	7.1		18.1	17.2	HOUR: 03
SW	.8	13.4	5.5	.8	20.5	19.7	
W	.8 .8	9.4	10.2	3.1	24.4	23.1	
NW	1.6	6.3	7.1		15.0	19.0	
CALM							
TOTAL	1.6 16.5	48.0	29.9	3.9	100.0	18.3	

SEPTEMBER DATA SUMMARY 44005
AVERAGE LATITUDE 42.7N AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.9	(20 06)	15.9	20.5	(07 03)	239	30
SEA TEMP (DEG C)	14.1	(26 00)	18.0	19.4	(05 18)	239	30
AIR-SEA TEMP (DEG C)	-06.1	(20 06)	-00.1	04.2	(07 03)	239	30
PRESSURE (MBAR)	0994.9	(07 00)	1018.2	1030.6	(24 15)	239	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 239
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	.8	6.3	6.7	1.3			15.1	12.1	MAX WIND
NE	.4	.4	2.9	1.3			5.0	15.1	SPEED: 38 KNOTS
E	.8	2.1	6.3				9.2	12.1	DIRECTION: 190 DEG
SE		.4					.4	5.0	DAY: 07
S		3.3	11.7	2.1	.4		17.6	15.6	HOUR: 00
SW	.8	4.2	20.5	1.7			27.2	14.0	
W		7.5	6.3		.4		14.2	11.4	
NW	.4	9.4	3.8	.8			10.5	11.1	
CALM	.8						.8	.0	
TOTAL	4.2	29.7	58.2	7.1	.8		100.0	13.0	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 150

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	22.0	61.3	14.7	1.3	.7				1.2M	4.5M	(07 03)

OCTOBER DATA SUMMARY 44005
AVERAGE LATITUDE 42.7N AVERAGE LONGITUDE 068.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.2	(10 18)	11.3	17.1	(06 06)	248	31
SEA TEMP (DEG C)	10.8	(31 12)	13.0	16.2	(03 18)	248	31
AIR-SEA TEMP (DEG C)	-07.9	(10 15)	-01.7	02.3	(22 00)	248	31
PRESSURE (MBAR)	0981.0	(08 03)	1016.1	1032.0	(31 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 248
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	.4	4.0	9.3	.8			14.5	13.0	MAX WIND
NE		2.8	1.2	.4			4.4	10.5	SPEED: 35 KNOTS
E		2.0	.8				2.8	10.0	DIRECTION: 230 DEG
SE	.4	3.2	6.0	1.2			10.9	13.6	DAY: 06
S		4.4	8.1	1.6			14.1	14.0	HOUR: 09
SW		4.4	11.3	2.8	.4		19.0	15.5	
W	.8	1.6	11.3	7.3	.8		21.8	19.1	
NW	.4	2.4	7.7	1.6			12.1	15.6	
CALM	.4						.4	.0	
TOTAL	2.4	25.0	55.6	15.7	1.2		100.0	15.1	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 158

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	17.1	53.2	24.1	5.1	.6				1.4M	4.0M	(08 18)

SEPTEMBER DATA SUMMARY 45001
AVERAGE LATITUDE 40.0N AVERAGE LONGITUDE 067.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.9	(29 03)	11.2	15.5	(05 12)	240	30
SEA TEMP (DEG C)	08.8	(18 12)	09.8	12.0	(03 21)	240	30
AIR-SEA TEMP (DEG C)	-02.5	(29 06)	01.4	05.2	(05 12)	240	30
PRESSURE (MBAR)	0998.3	(02 09)	1014.0	1024.3	(08 12)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 240
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	.4	6.3	3.3	.4			10.4	9.7	MAX WIND
NE	1.3	1.7	6.3				9.2	10.8	SPEED: 23 KNOTS
E	.4	4.6	.8				5.8	8.1	DIRECTION: 350 DEG
SE		5.8	3.8				9.6	9.6	DAY: 18
S	1.3	12.5	7.5				21.3	8.9	HOUR: 12
SW	1.7	8.3	3.8				13.8	7.9	
W	2.5	12.5	8.8				23.8	9.1	
NW		2.9	2.5				5.4	9.9	
CALM	.8						.8	.0	
TOTAL	8.3	54.6	36.7	.4			100.0	9.1	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 232

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	37.5	53.0	9.5						1.0M	2.5M	(20 18)

OCTOBER DATA SUMMARY 45001
AVERAGE LATITUDE 40.0N AVERAGE LONGITUDE 067.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	-00.6	(24 15)	05.5	11.0	(03 21)	247	31
SEA TEMP (DEG C)	03.4	(25 06)	06.6	09.7	(01 21)	246	31
AIR-SEA TEMP (DEG C)	-06.8	(12 09)	-01.1	04.1	(21 03)	246	31
PRESSURE (MBAR)	0993.9	(12 12)	1011.1	1024.8	(18 06)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 247
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	.4	8.1	15.4	3.6			27.5	13.6	MAX WIND
NE	.4	4.9	2.0	1.6			8.9	11.7	SPEED: 26 KNOTS
E	.4	5.3					5.7	7.5	DIRECTION: 020 DEG
SE	.4	5.7	13.0	.4			19.4	12.5	DAY: 23
S	.8	4.5	7.7				13.0	10.3	HOUR: 03
SW	.4	1.2	1.2				2.8	8.9	
W	.8	8.9	2.0				11.7	7.2	
NW	.4	5.3	5.3				10.9	10.2	
CALM									
TOTAL	4.0	43.7	46.6	5.7			100.0	11.2	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 242

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	32.6	47.5	12.4	5.4	2.1				1.3M	4.0M	(23 12)

SEPTEMBER DATA SUMMARY 45002
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.1	(07 12)	15.0	18.7	(08 21)	86	11
SEA TEMP (DEG C)	14.3	(25 06)	15.8	17.2	(08 06)	86	11
AIR-SEA TEMP (DEG C)	-05.9	(08 06)	-00.8	02.4	(29 03)	86	11
PRESSURE (MBAR)	1007.5	(06 09)	1016.9	1026.1	(08 15)	86	11

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 84
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	1.2	4.8	9.5				15.5	12.3	MAX WIND
NE	1.2	7.1	4.8	1.2			14.3	10.5	SPEED: 24 KNOTS
E		2.4					2.4	5.5	DIRECTION: 040 DEG
SE		3.6	8.3				11.9	13.2	DAY: 10
S	1.2	6.0	9.5				16.7	10.9	HOUR: 15
SW		6.0	9.5				15.5	10.9	
W	2.4	16.7	1.2				20.2	7.1	
NW		3.6					3.6	7.3	
CALM									
TOTAL	6.0	50.0	42.9	1.2			100.0	10.3	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 77

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	32.5	54.5	11.7	1.3					1.0M	3.0M	(10 03)

SEPTEMBER DATA SUMMARY 46001
AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.1	(26 09)	12.4	14.4	(12 15)	240	30
SEA TEMP (DEG C)	11.3	(30 21)	12.9	14.8	(08 03)	240	30
AIR-SEA TEMP (DEG C)	-02.8	(26 09)	-00.5	00.8	(12 15)	240	30
PRESSURE (MBAR)	0976.0	(30 21)	1003.2	1021.7	(19 00)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 240
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	.4	2.1	5.0	.8			8.3	12.8	MAX WIND
NE	.4	2.5	3.8				6.7	13.2	SPEED: 34 KNOTS
E	.4	4.2	3.3	4.2	.4		12.5	17.3	DIRECTION: 110 DEG
SE		.8	5.0	7.1			12.9	21.2	DAY: 30
S	.8	1.7	12.9	12.9			28.3	20.2	HOUR: 06
SW	.8	1.3	5.8	3.3			11.3	16.4	
W		1.3	6.7	1.3			9.2	15.7	
NW		1.7	5.8	2.9			10.4	18.2	
CALM	.4						.4	.0	
TOTAL	3.3	15.4	48.3	32.5	.4		100.0	17.7	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.4	33.8	36.7	22.1	7.1				2.3M	5.5M	(13 09)

OCTOBER DATA SUMMARY 45002
AVERAGE LATITUDE 45.3N AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	01.4	(25 15)	08.6	16.1	(01 18)	245	31
SEA TEMP (DEG C)	07.7	(26 12)	11.7	15.7	(02 06)	245	31
AIR-SEA TEMP (DEG C)	-03.1	(04 21)	-03.1	04.2	(31 21)	245	31
PRESSURE (MBAR)	0996.0	(23 06)	1011.8	1026.1	(18 06)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 246
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N	2.8	4.5	13.4	2.0			22.8	13.1	MAX WIND
NE	.8	3.7	11.8				16.3	12.1	SPEED: 26 KNOTS
E		3.3	4.9				8.1	11.3	DIRECTION: 350 DEG
SE	1.2	4.1	4.5				9.8	10.6	DAY: 13
S		2.0	9.3	.4			11.8	14.7	HOUR: 06
SW		2.8	5.3	.4			8.5	12.9	
W		.8	4.5	.4			5.7	13.1	
NW		4.5	11.0	1.6			17.1	14.3	
CALM									
TOTAL	4.9	25.6	64.6	4.9			100.0	12.9	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 206

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	27.7	55.8	14.1	2.4					1.2M	3.5M	(13 06)

OCTOBER DATA SUMMARY 46001
AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.9	(25 12)	08.9	11.5	(01 06)	246	31
SEA TEMP (DEG C)	08.6	(31 15)	09.7	11.3	(01 00)	246	31
AIR-SEA TEMP (DEG C)	-03.5	(25 09)	-00.8	00.1	(08 12)	246	31
PRESSURE (MBAR)	0968.9	(23 06)	0998.6	1021.3	(31 21)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

	SPEED (KNOTS)						TOTAL	MEAN SPEED	NO. OF OBS: 246
DIR	<4	4-10	11-21	22-33	34-47	>47	%	(KNOTS)	
N		.8	1.6	3.3			5.7	19.7	MAX WIND
NE	.4	.8	5.7	.4			7.3	14.9	SPEED: 40 KNOTS
E	1.2	2.8	1.2	3.3	1.6		10.2	19.2	DIRECTION: 210 DEG
SE		1.2	2.0	5.3	1.2		9.8	22.3	DAY: 05
S		1.2	8.9	15.0	1.2		26.4	22.5	HOUR: 03
SW	.4	1.2	7.7	8.1	2.4		19.9	21.6	
W		1.2	8.5	4.1			13.8	18.0	
NW	.4	.8	2.8	2.8			6.9	19.1	
CALM									
TOTAL	2.4	10.2	38.6	42.3	6.5		100.0	20.4	

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS): NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		8.2	25.5	34.2	23.0	9.1			3.4M	7.5M	(22 18)

SEPTEMBER DATA SUMMARY 46002
AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.6	(04 03)	17.7	19.4	(01 00)	240	30
SEA TEMP (DEG C)	18.8	(26 15)	19.1	20.6	(22 00)	240	30
AIR-SEA TEMP (DEG C)	-03.5	(04 03)	-01.3	-00.1	(01 09)	240	30
PRESSURE (MBAR)	0996.6	(01 12)	1016.3	1025.8	(10 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	9.6	30.4	2.5			43.3	14.5
NE		2.1	.8				2.9	9.9
E	.4	1.3	.4				2.1	8.0
SE		.4					.4	8.0
S		2.5	5.0	.4			7.9	13.5
SW	1.3	2.5	10.0	2.9			16.7	14.9
W	.4	2.5	12.9				15.8	13.3
NW	1.3	5.0	4.2				10.4	9.1
CALM	.4						.4	.0
TOTAL	4.6	25.8	63.8	5.8			100.0	13.4

NO. OF OBS: 240
MAX WIND SPEED: 28 KNOTS DIRECTION: 220 DEG DAY: 08 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		26.7	59.6	10.0	3.8				2.2M	5.5M	(30 00)

OCTOBER DATA SUMMARY 46002
AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.7	(28 06)	16.2	19.2	(13 21)	248	31
SEA TEMP (DEG C)	16.4	(31 18)	18.2	19.7	(04 00)	248	31
AIR-SEA TEMP (DEG C)	-05.1	(28 06)	-02.0	00.5	(24 15)	248	31
PRESSURE (MBAR)	0983.9	(24 15)	1015.4	1033.0	(29 06)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	10.9	18.1	.4	.4		30.6	12.7
NE	.8	6.0	6.9				13.7	10.6
E	.4	2.8	.4	.4			4.0	8.8
SE	.8	1.2	1.6				3.6	11.1
S		2.8	5.6	2.4	.8		11.7	17.9
SW		.8	4.8	5.6			11.3	21.1
W	.4	1.6	5.6	6.5	.4		14.5	19.8
NW		2.0	5.2	3.2			10.5	17.3
CALM								
TOTAL	3.2	28.2	48.4	18.5	1.6		100.0	15.3

NO. OF OBS: 248
MAX WIND SPEED: 38 KNOTS DIRECTION: 180 DEG DAY: 21 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		23.0	26.2	20.6	19.8	8.1	2.0	.4	3.2M	10.5M	(22 15)

SEPTEMBER DATA SUMMARY 46003
AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.2	(26 15)	11.3	13.0	(06 03)	240	30
SEA TEMP (DEG C)	09.5	(30 18)	11.8	13.0	(03 03)	240	30
AIR-SEA TEMP (DEG C)	-02.2	(23 21)	-00.5	00.9	(30 00)	240	30
PRESSURE (MBAR)	0993.1	(30 12)	1002.7	1021.9	(06 21)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		2.5	8.0	1.3			11.8	15.3
NE	.8	3.4	1.3	.4			5.9	9.9
E		2.1	2.5	.8			5.5	12.6
SE	.4	.8	2.9	1.3	.8		6.3	18.3
S		.8	3.4	2.9	.4		7.6	21.2
SW	.4		9.2	2.9			12.6	17.5
W	.4	2.5	18.9	6.3			28.2	17.2
NW		1.7	16.0	4.2			21.8	17.4
CALM	.4						.4	.0
TOTAL	2.5	13.9	62.2	20.2	1.3		100.0	16.7

NO. OF OBS: 238
MAX WIND SPEED: 35 KNOTS DIRECTION: 120 DEG DAY: 29 HOUR: 21

OCTOBER DATA SUMMARY 46003
AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	04.9	(25 18)	07.7	10.4	(02 00)	247	31
SEA TEMP (DEG C)	07.2	(31 21)	08.0	09.7	(01 00)	247	31
AIR-SEA TEMP (DEG C)	-02.6	(25 18)	-00.4	01.5	(04 00)	247	31
PRESSURE (MBAR)	0974.9	(09 00)	0997.2	1021.8	(19 21)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			.8	.8			1.6	21.8
NE				.4			.4	30.0
E			.4	2.0			2.4	23.5
SE			3.6	1.2	.8		5.7	20.8
S		1.2	13.4	8.9	.4		23.9	20.0
SW		1.2	16.6	10.9	.4		29.1	20.3
W		2.0	11.3	5.7	.4		19.4	18.3
NW			8.5	8.9			17.4	21.9
CALM								
TOTAL		4.5	54.7	38.9	2.0		100.0	20.3

NO. OF OBS: 247
MAX WIND SPEED: 38 KNOTS DIRECTION: 230 DEG DAY: 04 HOUR: 15

SEPTEMBER DATA SUMMARY 46004
AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.5	(28 21)	14.4	18.0	(02 21)	240	30
SEA TEMP (DEG C)	11.7	(30 12)	14.3	18.3	(02 21)	240	30
AIR-SEA TEMP (DEG C)	-02.4	(26 12)	00.1	02.5	(30 12)	240	30
PRESSURE (MBAR)	0985.1	(29 12)	1011.0	1025.6	(19 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4		.8	1.7			2.9	20.1
NE		1.3	.4	.8			2.5	15.0
E			.8				.8	14.0
SE	.4		1.7	.8	.8		3.8	22.8
S		2.9	21.3	10.8			35.0	17.5
SW	1.7	8.3	15.0	2.1			27.1	12.9
W	1.3	5.8	8.8	7.1			22.9	16.1
NW		1.3	1.3	2.1			4.6	18.9
CALM	.4						.4	.0
TOTAL	4.2	19.6	50.0	25.4	.8		100.0	16.1

NO. OF OBS: 240
MAX WIND SPEED: 39 KNOTS DIRECTION: 150 DEG DAY: 29 HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		30.8	37.1	22.1	9.2	.8			2.0M	7.5M	(29 12)

OCTOBER DATA SUMMARY 46004
AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.0	(30 00)	11.8	14.6	(09 15)	248	31
SEA TEMP (DEG C)	11.1	(01 00)	11.7	13.2	(12 06)	248	31
AIR-SEA TEMP (DEG C)	-02.7	(19 03)	00.1	02.4	(24 09)	248	31
PRESSURE (MBAR)	0955.9	(22 12)	1008.7	1027.4	(29 06)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N			1.6	2.0			3.6	21.4
NE		.4	.8	1.6			2.8	22.0
E	.4	1.6	.8	.4	1.2		4.4	20.1
SE		2.8	1.6	8.5	3.2		16.1	25.0
S		3.6	10.1	11.7	1.6		27.0	21.0
SW	.4	2.8	11.7	3.6	2.8		21.4	19.4
W	.8	3.6	5.2	4.4	3.2	.4	17.7	21.8
NW		2.0	4.8				6.9	13.2
CALM								
TOTAL	1.6	16.9	36.7	32.3	12.1	.4	100.0	20.9

NO. OF OBS: 248
MAX WIND SPEED: 49 KNOTS DIRECTION: 250 DEG DAY: 18 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		2.4	25.0	20.2	29.0	12.9	1.6		3.8M	8.5M	(22 09)

SEPTEMBER DATA SUMMARY 46005
AVERAGE LATITUDE 46.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.1	(27 12)	16.4	17.8	(21 00)	240	30
SEA TEMP (DEG C)	16.5	(08 15)	17.2	18.2	(21 00)	240	30
AIR-SEA TEMP (DEG C)	-02.9	(27 12)	-00.8	00.6	(30 21)	240	30
PRESSURE (MBAR)	0992.5	(08 03)	1015.6	1027.4	(10 18)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		8.8	16.3				25.0	12.0
NE		1.7	4.2				5.8	10.9
E		2.9	.4				3.3	8.0
SE		.4	1.7				2.1	12.2
S	.4	.8	7.5	4.2			12.9	18.1
SW	.4	4.2	8.3	2.9			15.8	14.8
W	.4	9.2	12.9	4.6			27.1	14.0
NW	.4	4.2	3.3				7.9	9.7
CALM								
TOTAL	1.7	32.1	54.6	11.7			100.0	13.4

NO. OF OBS: 240
MAX WIND SPEED: 32 KNOTS DIRECTION: 170 DEG DAY: 29 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 238

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	2.1	46.2	37.8	10.9	2.1	.8			1.9M	6.5M	(29 18)

OCTOBER DATA SUMMARY 46005
AVERAGE LATITUDE 46.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.8	(19 12)	14.5	17.7	(01 03)	246	31
SEA TEMP (DEG C)	13.3	(31 06)	15.8	18.0	(08 00)	246	31
AIR-SEA TEMP (DEG C)	-04.7	(19 12)	-01.3	00.8	(24 09)	246	31
PRESSURE (MBAR)	0978.8	(24 21)	1013.8	1032.6	(29 06)	245	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	7.7	8.9	2.8			21.1	12.7
NE	2.0	6.5	2.4	.8			11.8	9.1
E		4.9	1.2	.4			6.5	9.3
SE	.4	.4	2.0	2.4	1.2		6.5	22.2
S	.4	1.6	3.3	2.8	3.3		11.4	23.3
SW		.8	2.0	7.3	2.0		12.2	25.4
W	3.7	6.5	4.9	6.9	.8		22.8	14.9
NW	1.2	2.4	2.8	1.2			7.7	13.4
CALM								
TOTAL	9.3	30.9	27.6	24.8	7.3		100.0	16.0

NO. OF OBS: 246
MAX WIND SPEED: 42 KNOTS DIRECTION: 150 DEG DAY: 21 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		1.2	21.5	26.8	16.3	27.6	6.5		3.1M	7.5M	(22 21)

SEPTEMBER DATA SUMMARY 46006

AVERAGE LATITUDE 40.7N AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.3	(27 18)	18.2	20.0	(30 21)	240	30
SEA TEMP (DEG C)	18.0	(09 09)	19.0	20.5	(18 00)	240	30
AIR-SEA TEMP (DEG C)	-03.4	(27 18)	-00.8	01.2	(30 19)	240	30
PRESSURE (MBAR)	1001.6	(02 03)	1018.2	1027.0	(10 21)	240	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.9	2.1				5.4	8.7
NE	2.1	3.3	2.5	1.7			9.6	11.6
E	3.3	3.8	.4	.4			7.9	6.0
SE	3.8	6.3	1.7	.8			12.5	7.9
S	1.3	7.1	4.6				12.9	8.8
SW	2.1	5.0	5.8	1.7			14.6	11.3
W	.4	4.6	12.1	6.3			23.3	16.4
NW	.8	3.8	6.7	2.5			13.8	14.4
CALM								
TOTAL	14.2	36.7	35.8	13.3			100.0	11.6

NO. OF OBS: 240

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 270 DEG
DAY: 07
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 235

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	.9	32.3	48.5	12.8	5.5				2.2M	5.5M	(29 21)

OCTOBER DATA SUMMARY 46006

AVERAGE LATITUDE 40.7N AVERAGE LONGITUDE 137.7W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	12.3	(29 00)	17.0	20.4	(09 00)	235	31
SEA TEMP (DEG C)	15.8	(31 21)	17.8	19.6	(12 00)	236	31
AIR-SEA TEMP (DEG C)	-04.1	(22 12)	-00.8	01.5	(30 00)	235	31
PRESSURE (MBAR)	0991.6	(21 15)	1016.7	1033.4	(28 21)	235	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	.8	4.6	2.5			8.4	16.9
NE		2.1	5.1	.4			7.6	13.6
E	.8	8.0	2.1				11.0	8.1
SE	.4	5.1	1.7				7.2	8.9
S	1.3	5.9	11.8	5.9	.8		25.7	15.5
SW		.8	3.8	3.0			7.6	17.6
W		1.3	4.6	11.4	2.1		19.4	24.4
NW	.4	3.0	3.0	6.8			13.1	19.8
CALM								
TOTAL	3.4	27.0	36.7	30.0	3.0		100.0	16.6

NO. OF OBS: 237

MAX WIND
SPEED: 44 KNOTS
DIRECTION: 190 DEG
DAY: 21
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 223

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		11.7	35.0	18.4	24.2	7.6	2.7	.4	3.4M	11.0M	(22 06)

SEPTEMBER DATA SUMMARY 46009

AVERAGE LATITUDE 60.2N AVERAGE LONGITUDE 146.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.9	(29 06)	12.2	16.3	(05 03)	238	30
SEA TEMP (DEG C)	10.3	(29 15)	12.4	13.5	(09 06)	238	30
AIR-SEA TEMP (DEG C)	-04.0	(25 03)	-00.2	02.9	(11 21)	238	30
PRESSURE (MBAR)	0988.1	(27 21)	1006.8	1021.4	(19 09)	238	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	1.7	10.9	.4			13.4	12.8
NE	.8	2.5	1.3				4.6	8.0
E	.4	2.1	17.2	10.1			29.8	18.5
SE	.4	5.0	13.0	2.9			21.4	14.8
S	.8	2.9	15.5	.4			19.7	14.0
SW	.4	2.5	1.7				4.6	8.7
W	.4						.4	2.0
NW	.8	.8	2.5				4.2	9.6
CALM	1.7						1.7	.0
TOTAL	6.3	17.6	62.2	13.9			100.0	14.3

NO. OF OBS: 238

MAX WIND
SPEED: 31 KNOTS
DIRECTION: 130 DEG
DAY: 23
HOUR: 00

OCTOBER DATA SUMMARY 46009

AVERAGE LATITUDE 60.2N AVERAGE LONGITUDE 146.8W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(03 00)	10.2	11.7	(01 18)	45	6
SEA TEMP (DEG C)	10.5	(06 15)	11.2	11.7	(04 18)	45	6
AIR-SEA TEMP (DEG C)	-03.1	(03 00)	-01.0	00.8	(01 15)	45	6
PRESSURE (MBAR)	0987.6	(01 06)	0999.1	1015.3	(02 09)	45	6

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N								
NE								
E			17.8	2.2			20.0	20.7
SE		6.7	13.3				20.0	23.4
S	2.2	24.4	4.4				31.1	16.0
SW	4.4	17.8	6.7				28.9	17.7
W								
NW								
CALM								
TOTAL		6.7	48.9	42.2	2.2		100.0	20.5

NO. OF OBS: 45

MAX WIND
SPEED: 36 KNOTS
DIRECTION: 110 DEG
DAY: 03
HOUR: 00

SEPTEMBER DATA SUMMARY 42001

AVERAGE LATITUDE 26.0N AVERAGE LONGITUDE 080.0W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.9	(15 18)	27.8	30.1	(05 18)	197	26
SEA TEMP (DEG C)	27.7	(25 00)	28.9	31.3	(05 21)	197	26
AIR-SEA TEMP (DEG C)	-04.7	(15 18)	-01.1	00.7	(17 03)	197	26
PRESSURE (MBAR)	1002.3	(13 00)	1010.1	1014.7	(24 15)	197	26

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.5	6.0	10.1	5.0			22.6	14.3
NE	1.5	13.1	11.1	1.5			27.1	11.0
E	1.5	10.6	11.1	8.5			31.7	15.4
SE	3.0	2.0	3.0	1.0			9.0	9.7
S	.5	1.5	1.0				3.0	7.5
SW		1.5	.5				2.0	8.8
W	1.0	1.0	1.5				3.5	8.6
NW	.5		.5				1.0	7.0
CALM								
TOTAL	9.5	35.7	38.7	16.1			100.0	12.7

NO. OF OBS: 199

MAX WIND
SPEED: 31 KNOTS
DIRECTION: 090 DEG
DAY: 17
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 194

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	34.0	28.4	24.2	13.4					1.5M	3.5M	(18 15)

OCTOBER DATA SUMMARY 41003

AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES

	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.2	(27 06)	24.0	27.4	(03 03)	233	30
SEA TEMP (DEG C)	24.6	(26 00)	26.0	27.7	(10 00)	233	30
AIR-SEA TEMP (DEG C)	-06.2	(27 03)	-02.0	00.7	(20 21)	233	30
PRESSURE (MBAR)	1009.7	(11 06)	1015.7	1021.2	(15 15)	233	30

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.9	4.8	4.8	.9			11.3	12.0
NE	.4	.9	6.1	1.7	.9		10.0	18.2
E	.4	3.9	19.0	7.8			31.2	15.9
SE	.4	2.6	3.0	.4			6.5	11.5
S	.4	3.5	3.5	.9			8.2	11.3
SW	.9	1.7	1.3	3.0			6.9	16.3
W	.4	4.8	5.2	2.2			12.6	13.7
NW	.9	6.9	3.0	.4			11.3	9.2
CALM	2.2						2.2	.0
TOTAL	6.9	29.0	46.9	17.3	.9		100.0	13.7

NO. OF OBS: 241

MAX WIND
SPEED: 36 KNOTS
DIRECTION: 030 DEG
DAY: 14
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 230

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	23.5	42.6	32.6	1.3					1.3M	3.0M	(31 21)

Contined from page 129.

and 20th. On the 23d the 23,000-ton Indian HARGOBIND was at Ogishima with weather damage. The Greek BLUESKY reported heavy weather damage at Singapore. The 14,529-ton British EASTERN SAGA requested a weather-damage survey at Osaka on the 26th. The 2,956-ton Japanese TAKEO MARU overturned in heavy seas at Shakhtersh Port on Sakhalin Island on the 29th. Twelve crewmen died, and eight others were missing. Only one was safe but injured.

Other Casualties--The Taiwanese VICTORY GODDESS and SCHWARZHEIDE collided in a sudden gale on the 26th off Shuaiba Roads. The Panamanian COURTEOUS lost an anchor off Port Kembla on the 27th during heavy weather.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Selected Gale and Wave Observations, North Atlantic

September and October 1979

Vessel	Call Sign	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves†		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		SEP.															
VALLEY FORGE	WRGL	3	27.5 N	79.7 W	23	18	50	.5 NM	62	0992.8	25.8	29.4	7	11.5			
EXXON JAMESTOWN	KIYO	4	28.3 N	78.0 W	00	15	45	5 NM	62	1002.4	26.0	30.0	11	11.5			
MARIAS TAO-57	NZNL	4	29.7 N	77.8 W	06	10	50	2 NM	07	1006.1	23.4	28.9	3	10	12	7	10
VALLEY FORGE	WRGL	4	30.2 N	79.5 W	12	17	60	.5 NM	62	0996.2	25.6	28.9	10	19.5			
TEXACO WISCONSIN	WIGK	4	31.0 N	77.6 W	18	14	40	2 NM	16	1004.4	28.0	28.8	4	8	15	12	32.5
TEXACO WISCONSIN	WIGK	5	30.4 N	77.6 W	00	14	40	2 NM	16	1005.1	27.7	28.8	4	8	15	12	32.5
VALLEY FORGE	WRGL	5	32.8 N	78.4 W	06	17	45	5 NM	60	1004.7	26.1	27.8	9	18			
MOBILFUEL	WGEB	5	31.3 N	77.2 W	06	14	45	5 NM	02	1010.8	28.3	28.9	8	23	21	12	13
DELAWARE II	KNBD	6	41.8 N	70.4 W	18	15 M	45	1 NM	46	0999.0	20.0	18.9		10	15		6.5
EXXON HOUSTON	KHBA	11	24.8 N	83.7 W	00	11	50	2 NM	53	1000.5	28.0	30.0	5	5	11	< 6	8
SUGAR ISLANDER	KCKB	11	25.4 N	84.5 W	06	05	60	5 NM	00	1002.5	27.3		9	24.5			
SUGAR ISLANDER	KCKB	12	29.1 N	88.3 W	03	36	50	5 NM	58	1002.0	27.7		4	11.5	07	10	16.5
DALAMAR	TCCN	13	33.1 N	43.1 W	18	18	60	.25 NM	81	1010.5	26.0	25.0	7	26			
CANADIAN OWL	S6ED	15	35.8 N	73.4 W	00	21 M	38	2 NM	81	1010.5	25.5	27.0	18	32.5	21	>13	32.5
TFL DEMOCRACY	9VPR	15	44.3 N	30.7 W	12	16 M	45	.5 NM	07	0998.2	20.5	20.0					
SEALAND RESOURCE	WJKD	16	50.5 N	45.2 W	00	23	45	2 NM	80	0995.5	14.0	12.2	7	8	23	9	11.5
GOLDEN DOLPHIN	KIBM	18	25.3 N	50.5 W	21	14	50	2 NM	80	1012.5	25.0	26.1	4	8	14	6	10
EXPORT LEADER	WCJV	29	37.7 N	32.4 W	06	29	42	5 NM	01	1020.7	21.1	23.4	4	5	27	< 6	6.5
GREAT LAKES VESSELS																	
GEORGE M HUMPHREY	WF7895	7	47.4 N	87.2 W	00	01 M	44	10 NM	02		10.0	13.0	4	6.5			
HARRY COULBY	WA5661	10	47.5 N	87.7 W	12	04 M	46	5 NM	03		9.0	13.0	3	10			
JOHN DYKSTRA	WE8451	19	45.2 N	83.2 W	00	31 M	44	10 NM	01		12.0	15.0	5	5			
ENVIRONMENTAL BUOYS																	
42003		11	26.0 N	86.0 W	23	09 M	51			0983.0	26.0	28.9					
42003		12	26.0 N	86.0 W	00	09 M	66			0971.2	25.7	28.9	9	29.5			
		OCT.															
AMERICAN LEGEND	KFEY	4	48.1 N	36.6 W	12	31	45	5 NM	02	1003.7	14.0	15.6	10	19.5			
AMERICAN LEGEND	KFEY	4	48.3 N	33.8 W	18	31	55	2 NM	02	0999.0	11.7	14.4	9	29.5			
AMERICAN ARGOSY	KFCX	4	49.9 N	32.0 W	18	32	46	2 NM	64	0986.5	10.5	15.0	4	5	32	12	16
AMERICAN ARGOSY	KFCX	5	49.3 N	33.7 W	00	32	48	5 NM	16	0996.3	10.0	14.4			32	10	19.5
AMERICAN ARCHER	KFCS	5	45.8 N	28.5 W	18	29	50	2 NM	80	0995.5	13.5	16.7		34.5	32		24.5
AMERICAN LEGEND	KFEY	5	46.2 N	26.9 W	18	29	55	2 NM	62	0989.2	13.9	16.7	11	49			
AMERICAN ARCHER	KFCS	6	45.3 N	27.0 W	00	29	50	2 NM	80	0995.4	14.0	17.8			29		32.5
AMERICAN LEGEND	KFEY	6	45.6 N	23.8 W	06	29	55	2 NM	15	0986.1	15.0	16.7	11	49			
DYVI PACIFIC	LMCV	6	43.8 N	27.1 W	12	30	41	5 NM	58	1002.0	17.0		14	23	00		0
AMERICAN LEGEND	KFEY	7	45.5 N	18.8 W	00	25	30	10 NM	02	0991.5	16.7	17.8	9	32.5			
SEATRAIN GALVESTON	S6HM	12	46.0 N	20.6 W	06	30	45	5 NM	10	1000.2	12.0	16.0					
SEATRAIN CHARLESTON	OVYZ	21	52.1 N	23.4 W	12	15	41	2 NM	02	0988.6	15.2		8	16.5	15	13	26
AMERICAN ARGOSY	KFCX	21	50.3 N	20.3 W	12	16	45	5 NM	02	1001.0	14.4	14.4	5	11.5	16	8	16.5
DYVI PACIFIC	LMCV	24	40.5 N	61.4 W	21	23	50	5 NM	80	0998.0	23.0		11	16.5	19	11	16.5
SEATRAIN CHARLESTON	OVYZ	25	43.0 N	58.6 W	00	24	41	2 NM	97	0990.6	18.6						
ADM WM M CALLAGHAN	KGYE	26	42.9 N	18.2 W	00	29	45	5 NM	82	1019.5	15.7	15.7	4	10	31	< 6	19.5
GREAT REPUBLIC	WNRM	30	49.1 N	32.2 W	00	26	42	5 NM	02	1000.7	12.8	10.0	7	29.5			
GREAT LAKES VESSELS																	
PAUL H CARNAHAN	WR3953	7	45.0 N	83.1 W	06	31 M	42	5 NM	50		7.0	16.0	4	6.5			
ARTHUR M ANDERSON	WE4805	12	47.7 N	87.5 W	18	03 M	52	5 NM	02		2.0	9.0	8	11.5			
CHAMPLAIN	WA3533	12	47.7 N	89.3 W	18	36 M	48	5 NM	62		3.0	11.0	3	5			
ARTHUR M ANDERSON	WE4805	13	48.5 N	87.7 W	00	36 M	48	10 NM	60		1.0	11.0	5	8			
PHILIP R CLARKE	WE3592	13	43.7 N	82.5 W	06	27 M	41	10 NM	02		3.0	14.0	6	6.5			
MESABI MINER	WYQ4356	13	43.4 N	87.6 W	12	31 M	42	> 25 NM	02		3.0	12.0	10	10			
JOHN DYKSTRA	WE8451	22	48.2 N	87.4 W	18	04 M	43	10 NM	51		4.0	7.0		10			
IRVING S OLDS	WA6108	23	48.0 N	88.0 W	00	03 M	46	5 NM	63		- 2.0	10.0		10			
CHARLES M BEEGHLY	WL3108	23	47.8 N	85.1 W	18	03 M	45	2 NM	67		- 1.0	9.0	3	13			
J L MAUTHE	WE5184	23	47.8 N	85.3 W	18	02 M	42	5 NM	95		3.0	9.0	6	10			
ROBERT C STANLEY	WB2094	24	41.9 N	82.8 W	00	23 M	41	10 NM	02		8.0			3			

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

September and October 1979

Vessel	Call Sign	Date	Position of Ship Lat. deg.	Position of Ship Long. deg.	Time GMT	Wind Dir. 10s	Wind Speed kt.	Visibility n. mi.	Present Weather code	Pressure mb	Temperatures °C. Air	Temperatures °C. Sea	Sea Waves* Period sec.	Sea Waves* Height ft.	Swell Waves Dir. 10s	Swell Waves Period sec.	Swell Waves Height ft.
NORTH PACIFIC OCEAN		SEP.															
CORNUCOPIA	KPJC	1	42.7 N	127.0 W	18	20	N 42	1 NM	11	0996.4	18.1	18.4	2	5	19	< 6	8
SEATRAIN CHESAPEAKE	DSCC	1	45.5 N	143.8 W	23	29	N 42	10 NM	02	0995.5	16.0	17.0	12	14.5			
PRESIDENT JEFFERSON	WPGE	2	46.1 N	167.7 E	06	05	N 53	.5 NM	65	0990.2	10.0	11.7	5	6.5	05	6	29.5
NEW GOLDEN PHOENIX	3EYN	2	45.2 N	164.9 E	06	36	N 48	2 NM	61	0998.5	10.0	13.0	7	16.5	07	6	16.5
PRESIDENT TYLER	WEZM	2	44.0 N	163.2 E	12	36	N 45	5 NM	50	1001.9	12.2	12.8	10	23	01	8	26
VANGUARD	ABMR	2	48.1 N	166.3 E	12	03	N 42	5 NM	02	1004.3	10.0	11.0	4	8	03	6	16.5
PRESIDENT TYLER	WEZM	3	40.5 N	164.5 E	00	31	N 48	5 NM	00	0998.3	13.9	13.3	10	23	33	10	29.5
CELEBES	9VMD	5	38.4 N	172.4 W	06	31	45	5 NM	03	1000.8	20.0	22.0	4	8	32	7	11.5
PRESIDENT WILSON	WNPD	5	44.3 N	148.6 E	12	20	40	2 NM	65	0988.8	16.5	9.4	3	13	17	7	13
PRESIDENT HOOVER	WTSY	9	36.9 N	157.3 E	00	22	45	5 NM	02	1000.0	23.3	24.4	9	19.5			
CHALMETTE	SMMS	10	36.8 N	176.2 W	18	25	N 41	2 NM	07	0998.4	22.8	21.8	2	5	26	10	19.5
EVER SUMMIT	WOAU	11	38.5 N	164.4 W	00	22	N 46	5 NM	62	0989.0	19.5	20.0	4	3			
OGDEN SENEGAL	ABFO	11	39.7 N	166.9 W	12	26	N 48	5 NM	01	0996.1	19.0	19.0	10	11.5	31	12	13
PRESIDENT KENNEDY	KCAK	11	38.7 N	164.1 W	12	26	45	10 NM	02	0994.5	20.0	18.9	6	16.5	26	10	13
OGDEN SENEGAL	ABFO	12	39.2 N	161.3 W	06	27	N 41	5 NM	03	1003.0	19.0	18.0	10	11.5	27	12	13
GLACIER BAY	KACF	12	44.8 N	152.0 W	06	20	50	5 NM	01	0986.1	16.7	12.3	15	19.5	20	>13	32.5
YAMASHIN MARU	JBES	12	43.8 N	156.5 W	18	20	N 50	1 NM	63	0973.0	17.5	16.0	4	8	16	8	16.5
PRESIDENT MADISON	WCIP	12	51.7 N	148.5 W	18	16	50	.5 NM	63	0975.4	13.4	11.7	6	10	16	12	19.5
PRESIDENT MADISON	WCIP	13	51.4 N	146.0 W	00	19	45	.5 NM	63	0986.5	13.9	11.7	6	11.5	19	8	19.5
PORTLAND	WNDF	13	54.7 N	142.7 W	00	15	50	2 NM	15	0994.6	15.6	13.9	5	13	16	7	16.5
GLACIER BAY	KACF	13	45.5 N	152.5 W	00	27	35	5 NM	01	1006.5	17.8	13.4	7	11.5	26	12	32.5
PACIFIC VENTURE	WOVS	13	51.1 N	147.1 W	12	23	N 45	1 NM	03	0993.5	14.0	14.0	11	29.5	12	11	26
ATLANTIC PIONEER	WJWN	15	51.8 N	160.1 W	18	35	N 42	10 NM	03	0986.5	11.0	12.0	7	19.5	35	7	19.5
STAR DOVER	LEGY	16	52.6 N	166.9 W	06	29	45	5 NM	02	0999.0	8.0						
ATLANTIC PIONEER	WJWN	16	51.3 N	164.3 W	12	32	N 41	1 NM	03	0996.3	11.0	12.0					
LIONS GATE BRIDGE	JCLL	16	52.7 N	149.8 W	12	24	N 42	5 NM	02	0990.5	13.5	15.0	3	11.5	24	8	13
SILVER PHOENIX	DSNW	17	52.3 N	151.8 W	03	22	N 45	1 NM	62	0990.8	11.5	10.5	4	10	21	10	23
PRESIDENT GRANT	WEZD	17	47.0 N	176.7 W	18	20	42	2 NM	02	1015.0	13.4	10.6	6	11.5	21	9	18
ASIA HONESTY	ABLL	18	49.8 N	162.5 E	06	25	N 46	5 NM	06	1010.0	12.5	12.0	XX	8	27	6	13
ATLANTIC PIONEER	WJWN	18	50.9 N	177.2 W	12	24	N 42	5 NM	03	1005.3	14.0	9.0					
ATLANTIC PIONEER	WJWN	19	50.2 N	179.3 E	06	29	N 41	5 NM	03	1008.5	14.5	10.0	4	24.5	29	< 6	21
STAR DOVER	LEGY	20	47.6 N	166.0 E	06	24	55	2 NM	07	0990.5	13.0						
ATLANTIC PIONEER	WJWN	20	47.1 N	172.2 E	18	20	N 42	5 NM	03	0992.5	11.5	9.0	5	26	20	>13	26
ATLANTIC PIONEER	WJWN	21	47.2 N	171.7 E	00	32	N 43	10 NM	03	1007.0	10.5	9.0	7	23	32	>13	29.5
HOMSING ARROW	3ENE	22	51.9 N	167.2 W	06	32	N 45	1 NM	25	0985.0	10.0	11.0	5	10	32	6	26
PORTLAND	WNDF	22	56.5 N	148.2 W	12	18	50	2 NM	58	1001.0	10.6	10.6	4	13	22	8	19.5
EXXON NORTH SLOPE	KNLG	23	56.0 N	140.8 W	00	18	N 47	2 NM	21	1006.0	14.0	11.2	8	10	18	12	13
PACIFIC TRADER	WDGJ	24	49.7 N	159.8 E	00	26	N 43	1 NM	64	0983.0	8.7	15.0	8	10	26	12	13
LONG BEACH	WOEJ	24	51.6 N	166.9 E	06	26	N 48	2 NM	05	0998.2	8.0	8.0	18	29.5	26	>13	29.5
ALSTER EXPRESS	DIDL	24	54.6 N	170.6 W	12	19	48	2 NM	65	0999.0	7.5	9.0					
SOUTH EXPRESS	ABWR	26	50.2 N	167.9 E	12	38	N 49	2 NM	07	0989.5	9.0	10.0	6	29.5	30	8	34.5
CRESSIDA	3FTB	26	46.2 N	161.7 E	12	25	N 45	5 NM	02	1009.0	11.0	10.5	12	32.5	28	12	32.5
HONSHU GLORIA	ABPJ	26	47.9 N	178.9 W	18	27	N 45	10 NM	03	0995.0	12.0	13.0	6	11.5	27	7	13
HONSHU GLORIA	ABPJ	25	47.9 N	177.1 W	00	27	N 42	5 NM	03	0997.5	11.5	13.0	6	11.5	27	7	13
GLACIER BAY	KACF	26	54.8 N	148.3 W	06	18	45	5 NM	62	0999.3	8.9	8.9	XX	24.5	XX		24.5
SINCERE NO 5	ABGU	27	50.2 N	145.6 W	00	29	N 36	10 NM	80	1006.0	12.5	13.0	8	32.5	29	9	37.5
TAURUS	WDZW	27	25.1 N	126.5 E	09	34	45	2 NM	40	1001.0	25.6	24.4	10	21	35	10	29.5
SEALAND TRADE	WEUI	27	24.6 N	123.5 E	15	02	45	5 NM	02	1006.9	22.8	24.5	5	6.5	02	12	21
CONTINENTAL FRIENDSHIP	6ZMN	27	28.6 N	128.7 E	21	03	N 45	5 NM	03	1005.0	24.0	26.0			04	8	10
CONTINENTAL FRIENDSHIP	6ZMN	28	28.0 N	125.8 E	00	36	N 44	5 NM	02	1005.5	25.0	27.0	5	13	36	8	11.5
PRESIDENT MADISON	WCIP	28	29.8 N	127.4 E	00	02	46	5 NM	01	1004.1	24.5	25.0	5	10	05	11	19.5
PRESIDENT FILLMORE	WRDH	28	44.0 N	155.8 W	03	27	45	5 NM	02	0996.3	14.4	17.8	7	24.5	27	13	29.5
PRESIDENT TYLER	WEZM	28	34.3 N	170.3 E	06	02	N 50	5 NM	02	1010.0	22.2	23.9	5	16	02	< 6	19.5
SEALAND TRADE	WEUI	28	28.9 N	127.2 E	09	04	50	5 NM	02	0998.0	24.1	24.1	4	19.5	02	>13	32.5
VAN TRIUMPH	6ZJP	28	42.1 N	173.0 E	12	25	N 45	2 NM	59	0997.5	19.0	17.0					
HONSHU GLORIA	ABPJ	28	47.8 N	149.5 W	12	16	N 42	2 NM	05	0980.0	12.5	15.5					
GLACIER BAY	KACF	28	43.7 N	152.0 W	12	31	40	10 NM	61	1001.8	12.8	12.2		24.5	25		32.5
GLACIER BAY	KACF	29	43.0 N	152.8 W	00	31	30	10 NM	02	1011.7	14.0	13.4	5	16.5	32	10	32.5
HONSHU GLORIA	ABPJ	29	47.4 N	148.4 W	00	36	N 37	5 NM	03	0992.0	15.0	13.0	6	11.5	29	6	11.5
CHALMETTE	SMMS	29	48.3 N	152.1 W	00	31	N 27	10 NM	03	1002.6	11.0	11.0	9	19.5	04	8	32.5
AMERICAN COURIER	WAXH	29	32.1 N	126.5 E	00	02	48	5 NM	02	1006.4	23.3	24.7	5	10	02	7	19.5
PRESIDENT FILLMORE	WRDH	29	43.0 N	148.4 W	00	29	37	10 NM	02	1011.9	17.8	17.8	6	16.5	29	11	36
KEYSTONE CANYON	KSFK	29	53.9 N	138.4 W	00	10	50	2 NM	63	0994.9	12.2	12.2	3	19.5			
PORTLAND	WNDF	29	55.0 N	140.1 W	06	08	42	5 NM	63	0991.9	11.7	14.5	5	6.5			
SILVER PHOENIX	DSNW	29	36.4 N	165.6 W	09	25	N 43	10 NM	01	1003.5	23.0		9	19.5			
PACIFIC VENTURE	WOVS	29	46.0 N	154.2 W	12	14	N 60	200 YD	65	0985.0	13.0	12.0			14	9	23
HOTAKA MARU	JCZP	29	50.2 N	164.5 W	12	09	N 47	.25 NM	61	0988.5	10.5	11.0	6	10	09	7	19.5
GLACIER BAY	KACF	30	39.0 N	152.3 W	00	25	35	10 NM	02	1006.3	18.3	16.2	6	16.5	24		36
CHALMETTE	SMMS	30	48.9 N	143.4 W	00	15	N 48	2 NM	07	0994.3	13.0	11.9	5	13	25	8	11.5
JALA MUDRA	ATSI	30	40.6 N	160.4 W	06	30	30	5 NM	01	1006.9	16.6	17.0	6	16.5	33	10	36
KOREAN AMETHYST	D7BE	30	53.0 N	153.2 W	21	26	N 47	2 NM	62	0984.5	9.0	14.0	6	10	23	10	11.5
ENVIRONMENTAL BUOYS																	
46004		28	51.0 N	136.0 W	23	15	N 41			0998.5	12.7	13.3					
KOREAN AMETHYST	D7BE	OCT. 1	53.0 N	153.0 W	00	27	N 42	2 NM	28	0970.5	9.0	14.0	6	10	23	10	11.5
HOTAKA MARU	JCZP	1	49.5 N	150.4 W	00	24	N 43	2 NM	02	0993.5	13.5	12.0	6	10	24	9	19.5
VIENNA WOODS	SLOT	1	53.0 N	137.2 W	23	17	N 26	10 NM	03	1022.0	14.5	12.0	9	21	17	11	32.5
CONTINENTAL FRIENDSHIP	6ZMN	2	24.6 N	141.9 E	06	25	N 46	2 NM	62	1004.0	26.5	26.0	11	19.5			
VIENNA WOODS	SLOT	2	54.0 N	143.2 W	17	19	N 16	1 NM	60	0996.0	13.0	10.5	10	23	13	6	32.5
ARCO FAIRBANKS	WGWB	2	56.3 N	148.3 W	18	14	N 52	.5 NM	61	1004.8	10.5	11.7	8	18			
EXXON PHILADELPHIA	WNFJ	2	58.5 N	143.5 W	18	11	45	2 NM	07	1000.9	13.6	12.2	8	21	11	8	19.5
ARCO ANCHORAGE	WCIO	2	57.3 N	142.7 W	18	11	45	2 NM	63	1001.0	10.1	10.0	11	4.5	11	12	23
CORNUCOPIA	KPJC	2	58.7 N	150.0 W	18	09	45	1 NM	65	0992.4	8.3	10.4	2	6.5	09	< 6	18
CHEVRON ARIZONA	KGBE	2	58.7 N	150.7 W	18	08	N 50	2 NM	64	0991.8	7.2		5	26	09	8	16.5
SUNWARD	ELZT	2	52.9 N	137.1 W	18	18	41	2 NM	03	1013.0	13.0	11.0					
ARCO PRUDHOE BAY	KPFD	3	59.5 N	145.2 W	00	11	N 50	.25 NM	62	0999.2	10.6	11.7	6	11.5	13	8	16.5
EXXON PHILADELPHIA	WNFJ	3	58.0 N	142.3 W	00	17	45	.5 NM	21	0995.0	14.2	12.3	5	11.5	15	11	23
BELLMAN	9VUP	3	46.2 N	177.0 E	06	33	N 57	.5 NM	54	0975.0	10.0	10.0	2	11.5	21	6	13
UNIVERSE KURE	6ZAE	3	39.8 N	174.5 W	12	28	N 44	2 NM	58	0998.0	17.5	18.9	7	16.5	26	7	16.5
MAYA PIONEER	JLAK	3	41.4 N	173.4 W	12	24	N 58	< 50 YD	12	0991.8	15.0	12.8	14	16.5	24	6	6.5
VIENNA WOODS	SLOT	3	54.0 N	153.6 W	23	13	35	2 NM	54	0987.0	8.5	10.0	12	26	13	>13	41
PRESIDENT JEFFERSON	WPGE	4	52.6 N	150.6 W	06	16	N 55	2 NM	02	0985.1	13.3	9.4	8	18	15	11	19.5
SUNWARD	ELZT	4	54.1 N	146.4 W	06	20	46	1 NM	58	0996.5	11.5	9.0					
CHEVRON ARIZONA	KGBE	4	55.6 N	143.6 W	12	16	N 43	5 NM	63	0998.3	10.5						
ARCO PRUDHOE BAY	KPFD	4	59.9 N	145.3 W	18	11	N 55	.5 NM	63	0999.0	9.5	11.1	6	19.5			

Vessel	Call Sign	Date	Position of Ship		Time GMT	Wind			Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°		Speed kt.				Air	Sea	Period sec.	Height ft.		Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		OCT.																	
VIENNA WOODS	5LOT	4	54.0 N	162.4 W	23	23	M	38	1 NM	62	0980.0	9.0	8.0	10	29.5		23	6	41
EURO-ASIA CONCORDE	A8YN	4	54.1 N	161.7 W	23	26	M	49	1 NM	65	0980.8	9.0	10.0	7	10		26	7	10
MUNRO WHEC 724	NGDF	5	57.4 N	136.5 W	00	14	M	41	1 NM	07	1011.9	11.1	13.3	10	5		16	10	14.5
SUNWARD	ELZT	5	53.5 N	150.2 W	06	20		46	> 25 NM	03	1002.0	10.5	7.0						
KOFUKU MARU	JKLB	5	49.4 N	163.5 E	18	26	M	45	1 NM	02	0990.0	9.0	9.0	10	16.5		26	8	16.5
ADRIAN MAERSK	OYIT	5	51.1 N	162.2 E	18	28		41	2 NM	03	0990.0	8.0	6.0	4	8				
EASTERN TREASURE	6ZSP	5	44.2 N	175.2 E	18	24	M	42	2 NM	55	0999.8	14.0	12.0	9	16.5		22	11	14.5
WESER EXPRESS	DLDE	6	52.8 N	171.2 E	00	07		44	2 NM	51	0976.0	6.0	7.4	4	14.5		XX		16.5
KOREAN AMETHYST	C7BE	6	51.0 N	167.9 E	00	32	M	48	.5 NM	10	0969.0	6.0	11.0	XX	13		32	>13	16.5
MORNING ARROW	3ENE	6	53.9 N	145.9 W	01	22	M	30	10 NM	01	1016.0	11.0	12.0	5	3		22	< 6	32.5
PRESIDENT WILSON	WNPD	6	45.8 N	169.2 E	06	28		45	10 NM	07	1005.0	13.3	11.8	8	10		30	8	13
PACIFIC ARROW	JGFM	6	37.6 N	173.1 W	12	23	M	45	1 NM	62	0999.0	18.0	20.0	8	10		24	9	13
SPRUCE	JPQP	6	48.5 N	174.5 W	18	08	M	38	1 NM	02	0979.0	8.0	10.0	13	32.5		26	10	32.5
SEATRAIN INDEPENDENCE	DSKL	6	38.0 N	168.5 W	18	22		45	2 NM	60	0988.5	16.0	18.0	4	6		23	8	13
HOEGH MINERVA	LIGL	6	40.5 N	165.9 W	18	19	M	52	2 NM	81	0985.2	14.0					29		5
EASTERN TREASURE	6ZSP	6	44.9 N	178.9 W	18	32	M	42	5 NM	55	0998.3	10.5	11.0	9	16.5		33	10	14.5
EASTERN TREASURE	6ZSP	7	45.0 N	177.3 W	00	34	M	42	2 NM	02	0998.6	10.5	10.0	9	16.5		34	10	14.5
CELEBES	9VHD	7	41.7 N	163.0 W	00	13		45	1 NM	63	0979.0	12.6	13.0	8	13		13	8	26
PACIFIC ARROW	JGFM	7	37.5 N	175.9 W	00	30	M	50	1 NM	15	0998.0	17.5	18.5	9	11.5		30	12	32.5
EASTERN TREASURE	6ZSP	7	44.6 N	175.9 W	06	34	M	48	2 NM	02	0989.0	10.0	10.0	10	16.5		34	10	16.5
AMERICAN COURIER	WAXH	7	34.1 N	144.6 E	06	14		45	2 NM	00	1005.1	28.5	27.0	3	6.5		15	< 6	11.5
HOEGH MINERVA	LIGL	7	39.3 N	170.1 W	18	31	M	42	10 NM	80	0982.0	13.2					31		13
HOEGH MINERVA	LIGL	8	39.2 N	170.9 W	00	34	M	50	10 NM	80	0990.5	16.5					32	>13	16.5
VIENNA WOODS	5LOT	8	51.9 N	164.0 E	05	24		28	5 NM	60	0992.0	7.0	6.0	9	23		24	10	32.5
TRIUMPH	3EZZ	8	42.3 N	148.8 E	06	06	M	42	2 NM	15	1003.8	10.5	17.0	9	19.5		06	9	16.5
SPRUCE	JPQP	8	51.6 N	168.8 W	06	36	M	42	5 NM	01	0992.0	8.2	10.0	10	24.5		18	11	32.5
PACIFIC WING	H3WK	8	40.1 N	150.8 E	06	06	M	47	.5 NM	50	1001.4	19.0	20.0	12	24.5		06	>13	24.5
MUNRO WHEC 724	NGDF	8	57.5 N	150.0 W	09	08	M	44	1 NM	07	1000.0	9.4	10.0	6	13				
CHEVRON CALIFORNIA	WCGN	8	59.0 N	151.7 W	12	09		65	2 NM	65	0997.2	9.4	8.9	3	11.5		09	< 6	14.5
MOBILE MERIDIAN	KGSM	8	55.8 N	137.9 W	23	15	M	45	.5 NM	45	1007.8	13.0	11.7	4	32.5				
TRIUMPH	3EZZ	9	42.6 N	152.4 E	00	06	M	41	5 NM	15	1013.0	7.0	10.0	9	19.5		06	9	16.5
GLOBAL FRONTIER	H3AU	9	39.3 N	149.7 E	00	04	M	44	1 NM	80	1003.7	16.0	21.0	10	19.5		04	10	19.5
VIENNA WOODS	5LOT	9	49.5 N	161.6 E	05	30		35	5 NM	03	0992.0	7.5	7.5	11	28		30	11	36
PACIFIC VENTURE	H6VS	9	47.7 N	172.8 E	12	31	M	47	5 NM	66	0986.2	6.0	8.0	9	19.5		31	9	21
MORNING ARROW	3ENE	10	52.6 N	177.5 E	03	36	M	45	1 NM	07	0982.0	8.0	8.0	5	10		36	6	37.5
PRESIDENT ADAMS	KAAV	10	52.6 N	175.9 E	06	02		50	5 NM	03	0989.5	5.0	6.7	6	13		32	>13	26
SEALAND MCLEAN	WHDA	11	53.5 N	176.8 E	00	36		50	5 NM	02	0999.0	6.2	6.7	5	8		34	9	19.5
SUNWARD	ELZT	11	50.3 N	165.6 E	06	24		46	10 NM	03	1007.5	9.0	4.0						
SUNWARD	ELZT	12	49.4 N	160.4 E	06	24		46	> 25 NM	03	1011.5	7.5	4.0						
PRESIDENT JEFFERSON	WPGE	12	54.3 N	164.6 W	12	28	M	48	5 NM	02	0998.3	10.6	7.2						
PRESIDENT JEFFERSON	WPGE	13	53.9 N	174.8 W	06	23	M	45	5 NM	60	0999.6	5.6	6.7	4	5				
TRIUMPH	3EZZ	14	47.1 N	170.2 W	00	28	M	44	5 NM	01	0990.1	5.5	9.8	8	16.5		27	10	19.5
AMERICAN APOLLO	KEOD	14	14.1 N	132.9 E	18	21		45	2 NM	82	0993.0	27.8	27.8	7	14.5		32	8	16.5
NEWARK	WNDO	15	59.1 N	152.1 W	00	09		45	.5 NM	20	0995.8	10.0	10.0	4	11.5		09	< 6	23
TRIUMPH	3EZZ	15	47.2 N	163.0 W	00	28	M	42	2 NM	25	0988.7	7.5	10.0	8	16.5		27	11	21
EASTERN SABA	ZCUT	15	54.3 N	161.9 W	06	11	M	48	5 NM	02	0974.5	6.7	8.0						
DISCOVERER 055	WTEA	15	56.3 N	153.5 W	12	11	M	41	5 NM	62	0986.9	9.0	8.2	5	8		13	6	19.5
SEATRAIN TRENTON	9VAJ	15	29.6 N	140.7 E	18	02	M	56	.5 NM	65	1010.6	22.0	28.0						
AMERICAN APOLLO	KEOD	15	15.4 N	129.6 E	18	22		45	2 NM	82	0991.7	26.7	27.8	6	18		31	8	19.5
SEATRAIN TRENTON	9VAJ	16	29.7 N	142.3 E	00	02	M	48	.5 NM	65	1012.5	22.5	28.0	4	8		03	8	8
AMERICAN APOLLO	KEOD	16	16.2 N	128.0 E	06	24		45	2 NM	81	0991.5	28.3	27.8	6	18		29	8	19.5
TRANSCOLORADO	KOEW	16	32.9 N	136.9 E	18	07		42	5 NM	02	1018.2	22.3	23.3	6	8		06	8	8
TRANSCOLORADO	KOEW	17	33.9 N	139.8 E	00	06		42	10 NM	02	1019.5	23.8	24.4	6	6.5		06	10	11.5
AMERICAN APOLLO	KEOD	17	18.1 N	124.5 E	00	29		43	2 NM	02	0997.0	26.7	28.3	8	18				
PRINCE WILLIAM SOUND	WSDX	18	48.5 N	132.3 W	00	15	M	56	5 NM	51	0999.5	11.1	16.1	4	6.5		14	9	10
SANSINENA II	WSIN	18	51.1 N	136.6 W	00	14		41	5 NM	42	0985.0	13.3	12.8	11	11.5		14	< 6	11.5
TRIUMPH	3EZZ	18	48.4 N	137.5 W	06	27	M	45	5 NM	01	0999.5	11.0	15.0	8	16.5		25	9	16.5
JAMES E O'BRIEN	GNUQ	18	30.0 N	125.5 E	06	36	M	48	5 NM	02	0998.0	24.0	23.0	XX	18		03	11	21
MARGOBIND	ATPN	18	26.4 N	121.9 E	06	35		42	2 NM	07	1004.7	22.9	24.0	XX	16.5		35	< 6	19.5
PRESIDENT VAN BUREN	WWPI	18	34.8 N	129.6 E	12	05		45	5 NM	61	1003.6	20.0	23.3	4	10		06	8	16.5
ARCO FAIRBANKS	WGWB	18	51.2 N	135.5 W	12	27	M	50	2 NM	00	0983.4	11.0	11.1				27	9	14.5
ARIES	KGBD	18	25.7 N	135.0 E	12	17	M	45	5 NM	01	1004.1	27.8	25.6	6	19.5		22	< 6	18
MOBILE MERIDIAN	KGSM	18	55.8 N	136.1 W	17	08	M	41	> 25 NM	02	0986.1	11.8	11.2	5	13		15	11	29.5
COPNUCOPIA	KPJC	18	49.1 N	133.5 W	18	29		35	10 NM	03	0993.0	10.0	12.8	6	13		27	11	36
ALLTRANS EXPRESS	9VPU	18	28.8 N	136.0 E	23	22		60	1 NM	07	0999.0	27.0	27.0	7	6.5		22	>13	42.5
PRINCE WILLIAM SOUND	WSDX	19	51.5 N	135.7 W	00	25	M	50	5 NM	62	0978.0	9.5	13.4	7	29.5		25	8	32.5
CALIFORNIAN	KPIX	19	34.9 N	137.3 W	00	27		42	2 NM	50	1010.0	20.6	20.6	7	10		27	12	19.5
PORTLAND	WNDF	19	50.7 N	129.7 W	00	26		30	10 NM	02	0999.0	11.7	11.6	5	16.5		28	9	16
VANGUARD	A8MR	19	33.3 N	140.4 E	00	15	M	44	.5 NM	02	0999.7	26.5	26.0	6	10		16	9	14.5
ALLTRANS EXPRESS	9VPU	19	28.5 N	135.8 E	02	24		60	1 NM	07	1002.5	27.0	26.8	7	6.5		25	>13	42.5
PRESIDENT VAN BUREN	WWPI	19	38.3 N	135.6 E	06	02		50	2 NM	61	0989.5	17.8	21.1	4	10		02	7	16.5
PRESIDENT JEFFERSON	WPGE	19	32.2 N	140.4 E	06	19		65	5 NM	18	0993.6	27.8	26.2	6	8		19	9	36
IRIS ISLAND	JPKS	19	34.9 N	141.6 E	06	16	M	65	50 YD	45	0988.0	25.0	23.0	6	16.5		17	7	19.5
SEATRAIN YORKTOWN	DSNP	19	34.9 N	145.7 E	12	17	M	52	2 NM	02	0999.5	24.9	22.0		19.5				
TRANSCOLORADO	KOEW	19	41.6 N	156.1 E	12	14		45	10 NM	02	1018.5	15.7	15.7	6	8		XX		10
POLAR ALASKA	SLEU	19	36.4 N	142.1 E	12	10	M	65	.25 NM	62	0990.0	23.0	22.0	5	6.5				
UNIVERSE KURE	6ZAE	19	36.2 N	145.0 E	12	16	M	60	.25 NM	64	0988.0	24.0	23.8	9	21		16	10	21
PRESIDENT PIERCE	WUBV	19	39.2 N	148.1 E	18	20		45	1 NM	00	0985.8	19.4	13.3	4	13		18	10	23
SOUTH EXPRESS	A8WR	19	34.7 N	150.6 E	18	19	M	50	1 NM	02	1007.5	24.0	25.0						
SOUTH EXPRESS	A8WR	20	34.9 N	151.8 E	00	19	M	50	2 NM	02	1008.5	25.3	25.0	10	26		19	>13	29.5
PACIFIC WING	H3WK	20	43.4 N	135.3 W	00	32	M	45	5 NM	03	1000.4	14.0	15.0	15	23		32	>13	29.5
PRESIDENT PIERCE	WUBV	20	39.6 N	150.0 E	00	24		48	5 NM	02	0994.9	21.1	18.9	5	14.5		18	10	29.5
WORLD SUPREME	5LZF	20	46.3 N	154.5 E	00	14	M	54	700 YD	82	0982.0	7.0	4.0	7	36				
CRESSIDA	3FTB	20	37.5 N	172.3 E	06	02	M	17	10 NM	02	1024.5	21.0	15.7	8	32.5		09	8	32.5
WORLD MEDAL	5LOZ	20	40.3 N	161.2 E	09	18	M	43	2 NM	02	1010.0	19.5	21.0	7	19.5		18	9	19.5
EASTERN SAGA	ZCUT	20	46.8 N	156.7 E	12	20	M	62	200 YD	07	0978.5	11.6	7.0						
TRANSCOLORADO	KOEW	20	42.1 N	162.8 E	12	14		50	2 NM	60	1010.0	13.4	11.2	7	8		15	10	14.5
ARCO PRUDHOE BAY	KPFD	20	42.6 N	125.9 W	12	21	M	42	5 NM	13	0991.5	15.6	15.6	7	14.5				
VAN WARRIOR	5MEV	20	45.6 N	167.9 E	18	16		50	2 NM	63	1007.0	12.0	8.0						
VAN WARRIOR	5MEV	21	45.0 N	167.6 E	00	18		50	5 NM	03	1006.0	14.5	9.0						
TRANSCOLORADO	KOEW	21	42.2 N	165.5 E	00	20		45	1 NM	50	1015.0	15.0	10.0	8	13		XX		18
SKAUGRAN	LMUK	21	44.8 N	161.3 E	00	25		48	5 NM	02	1003.0	11.0	12.0	2	10		25	9	46
EXXON NEW ORLEANS	WNDW	21	46.1 N	126.2 W	06	14		45	10 NM	18	1002.5	17.3	16.7	3	10		14	6	8
JAPAN ACE	JKFS	21	38.3 N	144.6 W	06	22	M	46	2 NM	25	1003.5	20.0	19.0						

Vessel	Call Sign	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves*		Swell Waves	
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		OCT.															
PACIFIC WING	H3WR	21	39.3 N	146.3 W	12	32	N 60	5 NM	58	1003.5	14.0	17.0	15	28	32	>13	29.5
ALSTER EXPRESS	DIDL	21	42.5 N	145.2 W	18	30	52	2 NM	65	1000.5	10.8	13.0		16.5	32		29.5
PACIFIC TRADER	HGQJ	21	45.0 N	137.5 W	18	22	N 45	2 NM	03	0967.0	12.0	18.0	8	29.5	22	13	29.5
AUSTRAL LIGHTNING	WEZA	21	36.0 N	138.6 W	18	28	41	10 NM	15	1007.0	18.6	20.6					
ROSE CITY	WGJP	21	38.8 N	148.4 W	18	31	41	5 NM	08	1014.6	13.4	12.7	10	19.5	31	6	16.5
BELLMAN	9VUP	21	37.2 N	140.6 W	18	27	N 48	5 NM	21	1007.3	16.0	19.0	3	10	27	8	23
SEA FAN	9VYA	21	38.0 N	132.0 W	19	19	N 48	10 NM	03	1005.0	20.0	21.0	7	19.5	19	7	19.5
NEPTUNE DIAMOND	9VYT	22	47.6 N	129.9 W	00	15	N 56	.5 NM	07	0985.0	15.0	16.0	6	10	17	< 6	26
ROSE CITY	WGJP	22	38.7 N	147.0 W	00	30	44	5 NM	02	1012.1	14.4	12.7	12	19.5	30	12	26
AUSTRAL LIGHTNING	WEZA	22	36.0 N	138.5 W	00	28	N 44	5 NM	02	1003.7	16.1	20.0	4	10	28	8	39
CHEVRON CALIFORNIA	WCGN	22	51.1 N	135.7 W	00	13	45	1 NM	63	0971.0	12.8	11.1	4	14.5	13	>13	19.5
SEALAND FINANCE	WJKG	22	37.7 N	139.5 W	00	29	50	10 NM	02	1006.2	16.1	18.8	12	36	29	12	36
MOBIL ARCTIC	KSPY	22	52.2 N	137.0 W	00	10	58	2 NM	65	0973.2	10.5	10.5	5	6.5	09	10	14.5
WESTWARD VENTURE	KHJB	22	53.7 N	135.4 W	00	11	45	2 NM	60	0985.8	11.0	12.2	6	10	11	8	13
PRESIDENT KENNEDY	KCAK	22	37.6 N	143.2 W	00	29	50	5 NM	02	1010.5	18.9	18.3	10	19.5	29	13	23
PACIFIC TRADER	HGQJ	22	44.5 N	138.3 W	00	27	N 56	1 NM	07	0970.2	10.2	19.0	10	37.5	28	>13	32.5
ALSTER EXPRESS	DIDL	22	48.7 N	143.0 W	00	30	52	2 NM	02	1002.1	15.5	13.5	7	16.5	31	9	26
PACIFIC WING	H3WR	22	38.5 N	147.1 W	00	29	N 45	10 NM	03	1012.8	16.0	18.0	15	28	29	>13	29.5
NEVARK	WNDQ	22	52.1 N	132.0 W	06	13	45	1 NM	61	0977.5	11.7	13.8	4	14.5	14	10	11.5
EXXON PHILADELPHIA	WNFJ	22	43.3 N	127.2 W	06	25	45	2 NM	60	0997.5	19.0	16.7	4	6.5	20	7	18
SIMBA	OWEC	22	50.7 N	146.3 W	18	31	N 45	10 NM	25	0978.5	9.5	8.3	10	18			
PRESIDENT JOHNSON	WVHS	22	50.8 N	132.0 W	18	10	45	5 NM	60	0977.0	12.8	12.8	12	29.5	19	12	29.5
THOMPSON PASS	WSRY	22	55.3 N	137.2 W	18	11	45	2 NM	45	1006.8	10.6	11.7	4	26	85	7	14.5
EVER SPRING	H3WZ	22	37.7 N	159.7 W	23	30	N 43	5 NM	58	1008.5	19.0	17.0	4	8	30	6	10
PACIFIC WING	H3WR	23	37.9 N	155.5 W	00	29	N 58	50 YD	64	1002.0	16.0	17.0	12	19.5	29	>13	19.5
PRESIDENT JOHNSON	WVHS	23	51.5 N	134.7 W	00	19	48	5 NM	60	0973.5	10.6	12.2	9	29.5			
SIMBA	OWEC	23	49.9 N	144.2 W	00	29	N 42	10 NM	01	0981.3	11.0	6.7	10	18			
PRINCE WILLIAM SOUND	WSDX	23	58.1 N	143.2 W	06	08	N 45	2 NM	60	0970.0	9.7	11.2					
PRESIDENT KENNEDY	KCAK	23	37.4 N	154.3 W	13	30	45	10 NM	02	1007.0	15.6	17.2	6	13	30		19.5
CHEVRON WASHINGTON	KFDB	23	54.7 N	144.3 W	18	17	N 45	2 NM	03	0974.0	10.0		XX	16.5	18	7	19.5
CHEVRON CALIFORNIA	WCGN	23	57.6 N	148.2 W	18	01	45	1 NM	53	0966.9	9.4	8.3	3	8	13	< 6	24.5
EXXON BALTIMORE	WHMK	24	56.4 N	140.3 W	00	14	45	2 NM	63	0983.8	10.2	10.4	4	13	13	8	28
PAN WESTERN	DTSF	24	53.4 N	152.1 W	00	31	42	5 NM	00	0989.0	7.0	10.0	8	13	31	>13	19.5
ARCO JUNEAU	KSBG	24	57.8 N	140.5 W	18	14	N 50	5 NM	03	0988.2	10.6	5.4	5	11.5	13	< 6	23
SILVER PHOENIX	DSNW	24	48.9 N	130.0 W	21	10	N 52	2 NM	64	0983.5	13.5	11.0	6	23	11	8	23
SIMBA	OWEC	25	48.9 N	128.4 W	00	11	N 48	1 NM	53	0985.3	13.6	9.2	4	23			
PACMERCHANT	SNCB	25	44.9 N	131.0 W	18	31	N 48	2 NM	16	0993.5	12.0	15.8	7	13	29	12	23
SOUTH SKY	DSBA	25	43.4 N	147.8 W	21	27	N 45	5 NM	15	0999.4	12.0	14.0	4	5	27	8	8
OVERSEAS CHICAGO	KBCF	27	49.1 N	133.2 W	00	24	41	10 NM	02	1000.0	11.1	12.7	5	6.5	26	< 6	8
PRESIDENT JOHNSON	WVHS	27	52.9 N	171.2 E	06	26	47	5 NM	60	0993.8	6.7	6.1	6	29.5			
PORTLAND	WNDF	28	48.7 N	125.2 W	17	27	10	5 NM	50	1021.2	8.9	13.9	0	0	27	7	32.5
MOBILE MERIDIAN	KGSM	28	55.8 N	138.0 W	17	28	N 45	10 NM	28	1008.0	9.8	10.8	4	6.5	25	11	26
EXXON SAN FRANCISCO	KABC	30	47.5 N	130.7 W	00	16	55	1 NM	61	1013.5	13.5	13.0	5	16.5			
MOBILE MERIDIAN	KGSM	30	49.9 N	128.3 W	05	14	N 42	10 NM	29	1014.2	10.9	12.2	4	5	14	9	14.5
MUNRO WHEC 724	NGDF	30	55.3 N	156.1 W	12	19	N 44	2 NM	07	0996.8	7.6	8.9	6	10			
PORTLAND	WNDF	31	57.6 N	145.9 W	00	18	45	2 NM	58	1009.1	8.9	9.4	8	13	21	7	13
ENVIRONMENTAL BUOYS																	
46002		22	42.5 N	130.0 W	15	24	N 25			1001.3	13.1	17.3	13	34.5			
46004		17	51.0 N	136.0 W	23	12	N 46			0990.9	10.4	12.6					
46004		18	51.0 N	136.0 W	03	25	N 49			0979.5	10.1	12.4	9	18			
46004		19	51.0 N	136.0 W	04	25	N 43			0981.8	9.5	11.9					
46004		21	51.0 N	136.0 W	21	12	N 45			0978.3	11.3	11.0	9	18			
46004		22	51.0 N	136.0 W	07	11	N 44			0960.3	11.7	10.7					
46005		21	46.0 N	131.0 W	21	15	N 42			0987.4	14.8	15.3	8	13			
46005		23	46.0 N	131.0 W	18	24	N 41			0988.4	13.0	14.3	9	18			
46006		21	40.7 N	137.7 W	12	19	N 44			0993.9	16.8	17.2	6	14.5			
46006		22	40.7 N	137.7 W	10	28	N 33			1001.2	13.4	16.5	13	39			

→ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
28 Knotted wind

NOTE: The observations are selected from those with winds ≥ 33 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

September and October 1979

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
OGDEN THAMES	59	181
ADABELLE LYKES	35	55
AFRICAN MERCURY	13	
AGUADILLA	104	121
ALBATROSS IV	68	
ALISA	2	
ALMERIA LYKES	9	119
AMERICA MARU	93	28
AMERICAN ALLIANCE	29	97
AMERICAN ARGOSY	32	100
AMERICAN CHAMPION	23	37
AMERICAN COURIER	18	98
AMERICAN LANCER	41	142
AMERICAN LEGEND	96	100
AMERICAN RACER	10	39
AMERICANA	6	
AMOCO VOYAGER	1	
ANDERS MAERSK	23	67
ANTONIA JOHNSON	19	69
ARCO ENTERPRISE	8	
ARCO PRESTIGE	3	2
ARGONAUT		12
ARTHUR MAERSK	24	76
ASIA BRAVERY	11	79
ASIA INDUSTRY	6	
ATLANTIC PIONEER	19	115
AUSTRAL ENVOY	23	70
AUSTRAL PILOT	36	85
AXEL MAERSK	29	91
BARBER PRIAM		72
BAYAMO		76
BELLMAN	51	75
BLUE OCEAN	12	92
BORINQUEN	63	82
BRIGHT HOPE	24	
C V LIGHTNING	30	67
CALIFORNIAN	62	89
CARIBIA	11	
CHALMETTE	123	194
CHARLESTON	34	147
CHAVEZ	48	169
CHEVRON ANTWERP	24	197
CHEVRON COLORADO	40	55
CHEVRON KENTUCKY	141	
CHEVRON NORTH AMERICA		77
CHEVRON WASHINGTON	61	94
COLORADO	27	47
COLUMBUS LOUISIANA	30	
COMANCHE WMEC 202	25	25
CORAL ARCADIA	18	
COPONAGO	3	10
CRESSIDA	30	106
DAFFODIL		61
DAVID D. IRWIN	26	31
DEFIANCE	13	108
DELAWARE GETTY	44	111
DELTA AMERICA	4	
DELTA COLUMBIA	2	
DELTA PARAGUAY	10	
DIANA PROSPERITY	24	85
DJATISARI	8	22
DONA CORAZON II		76
DUBHE	10	
EAGLE CHARGER	3	
EASTERN JADE	25	
EASTERN RIVER		36
EASTERN WORLD	27	
EL PASO ARZEW	52	165
ELIZABETH LYKES	24	86
ESSO PALM BEACH	23	34
EURO-ASIA CONCORDE	38	76
EXPORT AGENT	18	29
EXPORT BUILDER	26	
EXPORT COMMERCE	1	6
EXXON BALTIMORE	26	39
EXXON CHESTER	3	9
EXXON HUNTINGTON	35	65
EXXON NEWARK	17	38
EXXON WASHINGTON	25	72
FESTIVALE	26	49
FREDERICK LYKES	28	128
GALLEON CORAL	13	
GARDENIA	9	
GEN HOYT S VANDENBERG	4	
GEORGE B KELEZ	22	
GIBRALTAR PANSY	9	
GOLAR BOW	1	
GOLDEN DOLPHIN	4	39
GOLDEN MISTRAL	1	
GRAND CARRIER	11	
GREAT OCEAN	13	74
GREEN HARBOUR	1	63
GUADALUPE	26	
GULF FARMER	8	63
GUNTHER SCHULTE	1	
HARNGJIN	4	
HELIOS	41	103
HIEI MARU	108	82
HOEGH MARLIN	3	61
HOEGH ORRIS	15	9
HONSHU GLORIA	60	159
HUDSON T-AO 194	4	32
INGHAM WMEC 35	52	95
IRONWOOD WLB 297	38	
J R GREY	7	177
JAG DARSHAN	44	
JAPAN ACE	121	40
JAPAN CADET	6	76
JELA TOPIC	12	8
JOSEPH HEWES	13	
KASHU MARU	34	17
KOPAS	112	161
KOREAN PRIDE	12	10
LABRADOR CLIPPER	35	
LAKE TAHOE	6	161
LAUREL	23	93
LETITIA LYKES	31	86
LIPSCOMB LYKES	46	87
LOUISE	77	136
LYNCH T-AGOR 7	49	137
MALMROS MONSOON	11	45
MANISTEE	12	
MANULEI	72	96
MARCONA EXPORTER	20	181
ACADIA FOREST	1	
ADM WM M CALLAGHAN	49	106
AFRICAN METEOR	28	45
AIMEE LYKES	10	
ALBERT MAERSK	24	37
ALLISON LYKES	3	27
ALSTER EXPRESS	39	142
AMERICA SUN	1	6
AMERICAN APOLLO	13	109
AMERICAN ARROW	22	
AMERICAN CHARGER	36	69
AMERICAN EXPLORER	57	89
AMERICAN LARK	43	111
AMERICAN LEGION	19	110
AMERICAN RANGER	38	97
AMOCO CAIRO		106
ANCHORAGE	8	75
ANNA MAERSK	34	97
AQUILA	26	17
ARCO FAIRBANKS	72	93
ARCO PRUDHOE BAY	76	153
ARIES		63
ARTHUR MIDDLETON	13	26
ASIA HERON	13	
ASIA MORALITY	21	45
AUSTRAL ENDURANCE	13	78
AUSTRAL LIGHTNING	45	91
AUSTRAL RAINBOW	66	123
B T SAN DIEGO	14	87
BARRANCA	62	
BAYANO	22	
BERGLJOT	15	28
BLUEBIRD	92	
BOSTON	2	23
BRINTON LYKES	38	74
C V STAGHOUND	23	91
CAMPBELL WMEC 32	5	72
CARMEN A	11	26
CHANCELLORSVILLE	17	71
CHARLOTTE LYKES	24	122
CHEROKEE WMEC 165		47
CHEVRON ARIZONA	85	143
CHEVRON COPENHAGEN		39
CHEVRON LONDON	2	149
CHEVRON OREGON	34	53
CHRISTOPHER LYKES	23	104
COLUMBIA RIVER L/V	399	433
COLUMBUS NEW ZEALAND	30	120
COMET	69	84
CORANTIJN	48	64
COSMOS GIENAH	1	
CRISTOBAL	26	63
DAMODAR GEN T.U. PARK	1	
DAVID P REYNOLDS	95	148
DEL ORO	14	55
DELAWARE II	154	173
DELTA ARGENTINA	8	54
DELTA ECUADOR	24	
DELTA PERU	4	54
DILIGENCE WMEC 616	5	
DOCTOR LYKES	52	136
DORIC	22	89
DYVI HATTEGAT	13	
EASTERN BRIDE	3	
EASTERN MARINER	1	
EASTERN SUN	28	37
EDELWEISS	3	
EL PASO HOWARD BOYD		44
ENNA G	48	9
ESSO PROVIDENCE	17	63
EVELYN MAERSK	1	
EXPORT AMBASSADOR	17	30
EXPORT BUYER	10	22
EXPORT FREEDOM	8	49
EXXON BANGOR	37	75
EXXON FLORENCE	1	
EXXON LEXINGTON	35	32
EXXON PHILADELPHIA	40	83
FAIRWEATHER	6	8
FLECTRANK	54	
FRIENDSHIP	23	162
GALLEON JADE	15	
GARTHNEWYDD	90	126
GENE TREFETHEN	31	
GEORGE H KELLER	15	168
GLACIER BAY	55	154
GOLDEN ARROW	117	84
GOLDEN EXPLORER	6	18
GOLDEN RAY	15	30
GRAND GLOBE	27	
GREAT REPUBLIC	27	94
GREEN ISLAND	8	5
GUAYANA	42	23
GULF MERCHANT	7	50
HAMILTON WMEC 715		68
HARUNA MARU	97	58
HELLESPONT GLORY	5	130
HELLYER BROWN	18	
HOEGH MERCHANT	2	2
HOEGH PRIDE		2
HOTAKA MARU	112	72
HUMACAO	7	23
IRIS ISLAND	37	45
ITAPUCA	5	5
J Y HIGGINS		168
JALAYAMINI	21	
JAPAN AMBASSADOR	43	31
JARVIS WMEC 725	48	163
JOHN S WAYERMAN	10	44
JOSEPH LYKES		64
KEIYO	11	41
KOREAN COMMANDER	10	
KRPAN	45	
LAKE BERRYESSA	10	10
LASH ATLANTICO	11	26
LEBA MAERSK	44	93
LEKA MAERSK	88	
LONDON CRAFTSMAN	1	
LOUISE LYKES	41	36
MAGDALENA	28	
MAMMOTH PIR	18	65
MANUANILI	115	187
MAR DE CORTEZ	12	77
MARCONA TRANSPORTER	13	40
ACE ENTERPRISE		32
ADRIAN MAERSK	40	121
AFRICAN NEPTUNE	1	32
ALASKA STANDARD	34	56
ALEUTIAN DEVELOPER	12	10
ALLTRANS ENTERPRISE		72
ALVA MAERSK	21	57
AMERICAN ACCORD	47	118
AMERICAN AQUARIUS	38	144
AMERICAN ASTRONAUT	30	117
AMERICAN CHIEFTAIN	8	49
AMERICAN HERITAGE		29
AMERICAN LEADER	28	114
AMERICAN LIBERTY	24	123
AMERICAN RELIANCE	18	107
AMOCO CONNECTICUT	1	
ANCO STANE	73	
ANNIE JOHNSON	14	66
ARAS	24	
ARCO HERITAGE	4	17
ARCO LAKE RIVER	75	109
ARILO MAERSK	28	66
ASHLEY LYKES	29	28
ASIA HONESTY	18	47
ASIA ZEBRA	50	
AUSTRAL ENSIGN	34	92
AUSTRAL MOON	48	112
AVILA	4	7
BALD BUTTE		80
BARWA	22	119
BAYNES	1	
BERNES	30	
BOBASARI OUA	4	
BRAZOS	39	85
BUNGA SRIPAGI	11	
CAGUAS		4
CAPRICORN	23	21
CARNIVALE	53	69
CHARLES LYKES	30	85
CHASTINE MAERSK	20	8
CHERRY VALLEY	15	38
CHEVRON BURNABY	14	69
CHEVRON EDINBURGH	29	109
CHEVRON LOUISIANA	12	
CHEVRON PERNIS	38	124
CHUEN ON	2	
COLUMBUS AMERICA	25	
COLUMBUS VICTORIA	31	103
CONALCO	37	116
CORNELIA MAERSK	1	
COURAGEOUS WMEC 622		41
CRYSTAL REED	12	3
DANWOOD ICE	15	21
DAVID BACHARD		113
DEL RIO	25	81
DELAWARE SUN	26	42
DELTA BRASIL	13	40
DELTA MAR		19
DELTA URUGUAY	3	14
DISCOVERER OSS	64	77
DOLLY TURMAN	18	92
DRUCILLA U	1	
DYVI PACIFIC	29	47
EASTERN DIAMOND		78
EASTERN MUSE	7	
EASTERN TREASURE	21	44
EDGAR M QUEENY	39	57
EL PASO SONATRACH	4	
ERNA OLDENDORFF	1	
ESSO TOWNSITE		2
EVER SPRING	25	56
EXPORT BANNER	40	80
EXPORT CHALLENGER	5	34
EXPORT LEADER	16	48
EXXON BATON ROUGE	4	6
EXXON GETTYSBURG	8	28
EXXON LEXINGTON	10	30
EXXON SAN FRANCISCO	22	41
FALSTRIA	26	101
FORT HOSKINS	1	44
FROTANORTE	2	
GALLEON PEARL	22	63
GEDIZ	4	
GENEVIEVE LYKES	33	91
GEORGE WALTON	15	
GLOBAL FRONTIER	33	98
GOLDEN DAISY	31	79
GOLDEN GATE	42	66
GOLDEN ROD	7	
GREAT CONCERT	1	
GREEN AUKLET	51	
GREEN VALLEY	17	32
GULF RANGER	4	12
GULF SKIPPER	17	38
HANJIN INCHEON		14
HAVKATT	1	
HERON	53	71
HOEGH CLIPPER		34
HOEGH MERIT	14	59
HONSHU ARROW	3	41
HOUSTON	1	38
INACHUS STAR	38	109
IRIS QUEEN	110	
J E GOSLINE	27	40
JACKSONVILLE	14	65
JAMES E O'BRIEN	15	77
JAPAN AMBROSE	40	28
JEAN LYKES	20	24
JOHN LYKES	54	59
JUTHLANDIA	22	62
KEYSTONER	55	108
KOREAN PIR	12	
KUROSHIO MARU	27	25
LAKE PALOURDE	5	173
LASH ITALIA	13	56
LEO	29	41
LIGHTVESSEL WLV 604	3	
LONG BEACH		88
LUIGI GRIMALDI	31	
MAINE	56	45
MANHATTAN	20	
MANUKAI	107	142
MARCHEN MAERSK	37	56
MARCONA VENTURER	30	
ACONCAGUA	10	24
AFRICAN COMET	12	49
AFRICAN SUN	3	
ALASKAN	40	82
ALEX STEPHENS	15	
ALLTRANS EXPRESS	43	110
AMELIA TOPIC	4	65
AMERICAN ACE	17	80
AMERICAN ARCHER	91	111
AMERICAN CHALLENGER	4	73
AMERICAN CORSAIR	14	56
AMERICAN INDEPENDENCE	19	50
AMERICAN LEGACY	57	126
AMERICAN LYNX	15	125
AMERICAN TRADER	44	257
AMOCO MILFORD HAVEN	33	53
ANCO TEMPLAR	58	
ANTE TOPIC	1	
ARCO ANCHORAGE	38	50
ARCO JUNEAU	74	105
ARECIBO	62	94
ARNOLD MAERSK	32	68
ASIA BEAUTY	8	
ASIA HUNTER	2	
ATHEL LAADKI	33	
AUSTRAL ENTENTE	38	56
AUSTRAL PATRIOT	9	100
AXEL JOHNSON	15	4
BALTIMORE TRADER	34	78
BASSWOOD WLB388	5	
BEL HUDSON	1	
BIBB WMEC 31	8	19
BOBASARI SATU	4	24
BREWSTER	68	157
BUTTONWOOD WLB 306	1	
CALIFORNIA RAINBOW	3	8
CARBIDE SEADRIFT	27	147
CEDRELA	41	47
CHARLES PIGOTT	12	144
CHAUVENET T AGS 29	1	
CHESNUT MILL	28	73
CHEVRON CALIFORNIA	73	129
CHEVRON FELIX	9	165
CHEVRON MISSISSIPPI	67	113
CHEVRON PERTH	18	106
CITRUS WLB300	18	
COLUMBUS AUSTRALIA	8	111
COLUMBUS WELLINGTON	45	73
CORAL ACE	14	
CORNUCOPIA	31	101
COVADONGA	8	74
CUMBERLANDIA	5	
DARIEN	2	
DAVID STARR JORDAN	32	58
DEL SOL	10	30
DELTA AFRICA		30
DELTA CARIBE	27	
DELTA MEXICO	8	19
DELTA VENEZUELA	14	45
DITTE SKOU	4	91
DON CARLOS	11	29
DUANE	7	10
EAGLE	5	
EASTERN FORTUNE	4	8
EASTERN PACIFIC	42	33
EASTERN WISEMAN	19	
EL MENCO	1	
EL PASO SOUTHERN	19	41
ESSO BAYONNE	3	29
EUGENIO C.	2	
EVER SUMMIT	4	90
EXPORT BAY	5	
EXPORT CHAMPION	2	6
EXPORT PATRIOT	12	78
EXXON BOSTON	25	32
EXXON HOUSTON	37	72
EXXON NEW ORLEANS	15	24
EXXON SUNSHINE STATE	1	
FEDTRADE	14	21
FRANCIS SINCERE NO 6	44	62
GALAXY	1	
GAMBHIRA	1	
GEMINI	5	
GENISTA	1	5
GIBRALTAR MARU	28	31
GLOMAR CHALLENGER	185	222
GOLDEN DAISY	29	16
GOLDEN GATE BRIDGE	109	87
GRACE	1	
GREAT LAND	57	98
GREEN FOREST	4	
GREEN WAVE	17	52
GULF BEAR	4	
GULF TRADER	11	12
HARDANGER	17	34
HAWAIIAN CITIZEN	48	77
HESS VOYAGER	3	
HOEGH MALLARD	7	26
HOEGH OPAL	5	
HONSHU BREEZE		8
HOWELL LYKES	31	104
INGER	7	144
IRIS WLB398	14	
J LOUIS	44	89
JADRAN	54	
JAMES LYKES	17	31
JAPAN	74	153
JEFF DAVIS	3	
JOHN TYLER	41	76
K H CRANDALL	29	62
KOFUKU MARU	25	129
KOREAN JUPITER	2	21
L.H. FUNKHOUSER	10	196
LAKE SHASTA	6	102
LASH PACIFICO	5	26
LESLIE LYKES	34	85
LIONS GATE BRIDGE	116	62
LOKO NIAGARA	4	
LUMLINE	118	169
MARLORY LYKES	9	50
MANHATTAN DUKE	36	119
MAPULANI	99	125
MARCONA CONVEYOR	33	110
MARGARET LYKES	34	121

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS SEPTEMBER AND OCTOBER 1979

SHIP NAME	VIA RADIO	VIA MAIL
MARIA RUBICON	18	
MARITIME CHALLENGE	19	
MATHIESON	27	
MAURICIO DE OLIVEIRA	39	45
MAYO LYKES	10	92
MEDITERRANEAN CARRIER	7	48
MEONIA	25	100
MIDGETT WMEC 726	64	136
MING AUTUMN	18	29
MOBIL AERO	23	39
MOBIL VENTURE	1	
MOBILOIL	11	24
MONTICELLO VICTORY	8	
MORMACARGO	11	48
MORMACTIGEL	3	23
MORMACSTAR	25	121
MORMACWAVE	24	108
MT MITCHELL	72	93
NECHES	39	60
NEWARK	44	108
NOPAL SEL	5	
NORSE PILOT	53	78
OCEAN LOG	23	32
OGDEN FRASER	13	
OLEANDER	100	107
ORE JUPITER	30	
ORIENTAL LEADER	15	75
OTTO N. MILLER		102
OVERSEAS JUNEAU	31	68
OVERSEAS VIVIAN	1	
PACDUCHESS	16	9
PACIFIC ACE	16	
PACIFIC GLORY	24	
PACIFIC WING	6	147
PACMERCHANT	9	14
PACSTAR	13	19
PARALLA	16	32
PENMAR	25	
PHILIPPINE RIZAL	15	87
PIONEER COMMANDER	26	82
PIONEER MOON	30	53
POTOMAC	2	
PRESIDENT HARRISON	28	78
PRESIDENT KENNEDY	63	126
PRESIDENT POLK	67	103
PRESIDENT VAN BUREN	65	134
PROGRESSUS	84	37
PVT LEONARD C BROSTROM	7	
R G FOLLIS	13	61
RELIANCE WMEC 615	1	
RIBEIRA GRANDE	37	
RIO MAMMO	1	
ROBERT TOOMBS	19	
ROYAL VIKING SEA	5	
SACRAMENTO		41
SAMOA	28	39
SAN MARCOS	49	98
SANTA CLARA	39	14
SANTA MERCEDES	7	21
SEA FAN	12	38
SEALAND ECONOMY	34	109
SEALAND LEADER	47	135
SEALAND PRODUCER	12	118
SEALIFT PACIFIC	8	
SEATRAIN PRINCETON	40	69
SEAWAY DISPATCH	53	139
SHELDON LYKES	18	65
STAR BAY	1	
SINCERE NO 5	17	5
SNOW CRYSTAL	2	24
SOMIO INTREPID	1	
SOUTHWARD	21	38
STAR DOVER	41	93
STELLA LYKES	15	
STONEWALL JACKSON	20	47
SUGAR ISLANDER	33	68
SUSAN MAERSK	1	
T F L INDEPENDENCE	6	109
TAI TUNG	10	23
TARANTEL	1	
TENNESSEE	4	
TEXACO MISSISSIPPI	3	7
TEXAS SUN		60
THOMAS G THOMPSON	28	
THOMAS NELSON	14	
TOBIAS MAERSK	8	29
TOWNSEND CROMWELL	68	77
TRANSCOLORADO	30	100
TROLL LAKE	78	
ULTRASEA		31
UNITED SEA ANGEL	38	54
VAN CONQUEROR	27	127
VANGUARD	15	48
VIGOROUS WMEC-627	11	37
WASHINGTON TRADER	39	49
WESTWARD VENTURE	66	93
WILMINGTON GETTY	44	53
WORLD CANDOUR	1	
WORLD RUBY	20	
YAMASHIN MARU	102	96
YUKON T-AO 202	6	33
ZIM HONGKONG	19	
ZOELLA LYKES	13	39
A8TF	20	152
C5CN	4	93
D2DU	2	19
D5GA		7
D5GM	24	88
D8QC	12	14
ELXT	9	44
SUSF	21	60
H3ML	5	30
H3XV	12	28
J3MT	22	14
KFQV	19	52
KHLR		37
KJD6	32	109
KVPN	42	39
LFEL	11	28
LZW6		14
WA6N		458
PPQI	3	28
S6IB	9	28
S6UM	53	132
WB2W	58	85
WFRY		4
W5N5	7	7
WY27373		9
ZCUT	6	25
3EEZ		23
3FM5	39	80
5LY8	4	41
5MUJ	9	24
8KCC	5	6
9VPV	32	68

SHIP NAME	VIA RADIO	VIA MAIL
MARIA TOPIC	13	34
MARITIME HARMONY	15	
MATSONIA	80	148
MAYA PIONEER		62
MC ARTHUR	18	13
MELLON WMEC 717	19	
MERCY	13	
MIDIGIRL	1	
MING LEADER	8	
MOBIL ARCTIC	35	111
MOBILE MERIDIAN	37	73
MONMOUTH	16	37
MOON RIVER		89
MORMACCAPE	1	
MORMACSAGA	7	63
MORPACSUN	45	119
MORNING GLORY	22	
MUNRO WMEC 724	5	60
NEPTUNE RUBY	36	
NEWCASTLE CLIPPER	89	
NORDNVAL	2	
NORTH STAR III	25	104
OCEANIC	67	172
OGDEN JORDAN	2	
OLGA TOPIC	16	
ORE SATURN	8	
ORIENTAL QUEEN	15	
OVERSEAS ALEUTIAN	9	48
OVERSEAS NATALIE	3	
OVERSEAS WASHINGTON	1	
PACDUKE	4	
PACIFIC ARROW	118	80
PACIFIC PEACE	12	
PACKING	1	
PACPRINCE	11	
PAN ASIA	5	
PAUL L FAHRNEY		45
PENNSYLVANIA SUN	12	37
PHILLIPS TEXAS	1	
PIONEER CONTENDER	13	69
POLAR ALASKA		198
PRESIDENT ADAMS	37	105
PRESIDENT JACKSON	22	
PRESIDENT MADISON	47	137
PRESIDENT TAFT	55	142
PRESIDENT WILSON	23	53
PROSPERITY	31	17
QUEENS WAY BRIDGE	109	79
RAINIER	17	32
RESEARCHER	81	150
RICHARD	62	91
RIO OLIVIA	23	26
ROSE		128
ROYAL VIKING SKY	83	121
SALVADOR	25	49
SAMUEL CHASE	6	
SANROSTAR	9	
SANTA MAGDALENA	37	59
SANTA PAULA	2	
SEA SOUNDER	1	
SEALAND EXCHANGE	57	132
SEALAND MARKET	26	89
SEALAND RESOURCE	38	104
SEATRAIN INDEPENDENCE	40	113
SEATRAIN TRENTON	104	174
SENTINEL	5	45
SHING ON	4	17
SILVER PHOENIX		37
SINCLAIR TEXAS	6	88
SNOW HILL	4	
SOLON TURMAN	7	74
SPRUCE	26	113
STAR HONGKONG	14	
STEPHANIE	1	
STRONG HUNTER	4	
SUNNY STATE	20	
SUSQUEHANNA	3	
T F L LIBERTY	24	42
TALUGA T-AO-62	35	48
TAUBE		11
TEXACO CONNECTICUT	8	22
TEXACO MONTANA	2	
TEXAS TRADER	3	
THOMAS JEFFERSON	9	16
THOMPSON LYKES	23	69
TOKYO RAINBOW	28	57
TOYOTA MARU 10	123	62
TRANSOLUMPIA	9	34
TROPICANA	17	
UNION CONCORD	28	32
UNIVERSE	27	
VAN FORT	3	
VELMA LYKES	25	30
VIOLET	24	9
WECOMA	109	105
WESTWIND WAGB 281	121	
WINTER STAR		3
WORLD HERCULES	1	13
WORLD SUPREME	18	14
YOCONA WMEC 168	4	
ZEALAND VENTURE	10	
ZIM MONTREAL	9	
ATGY	1	21
A8TV	8	18
C2DS		79
D2JF		115
D5IY	15	6
D5QC	43	91
ELCJ	17	43
ELKU		4
GYEV	48	57
H3MO	58	71
H8DE	23	31
JH8Q	47	48
KFEV		22
KHLO		2
KPKL	15	31
KVTN		13
LHUK	38	48
N8SZ		122
NRPT		22
PYXY		1
S6LU	32	66
TCCH	3	39
WEAZ		57
WIDK		6
WSPP	6	16
W2YY373		9
2FCB	41	59
3EGR	11	68
3FYC	3	5
5MOJ	13	42
6ZJC	14	24
8KIF	59	19
9VBP	30	1

SHIP NAME	VIA RADIO	VIA MAIL
MARIA U	7	
MARJORIE LYKES	10	13
MAUI	80	135
MAYAGUEZ	22	127
MEADOWBROOK	28	93
MELVIN H. BAKER	86	
METEOR T-AKR 9	36	101
MILLER FREEMAN	77	29
MING SPRING	46	15
MOBIL LUBE	16	47
MOBILFUEL	90	107
MONREALE	1	
MORANT	10	
MORMACDRACO	21	66
MORMACSEA	2	18
MORMACTIDE	7	84
MOUNT VERNON VICTORY	9	76
NANCY LYKES	44	114
NEW ENGLAND TRAPPER	2	23
NOBANAY	16	27
NORDIC LOUISIANA	59	
OCEAN DUKE	12	
OCEANOGRAPHER	93	107
OGDEN SENEGAL		93
ORCO MINER	4	42
ORIENTAL COMMANDER	24	28
ORIENTAL SOVEREIGN	33	9
OVERSEAS ARCTIC	36	29
OVERSEAS NEW YORK	13	39
PACBARON	14	30
PACEMPEROR	10	
PACIFIC ERA	51	93
PACIFIC SAGA	50	8
PACLADY	6	
PACPRINCESS	31	6
PAN PACIFIC	19	47
PAUL PIGOTT	1	
PERRYVILLE	13	
PINE LIGHT	9	11
PIONEER CONTRACTOR	10	
PORTLAND	56	118
PRESIDENT CLEVELAND	31	98
PRESIDENT JEFFERSON	77	162
PRESIDENT MC KINLEY	58	144
PRESIDENT TAYLOR	12	
PRINCE OF TOKYO	51	
PUEBLA	3	
QUINTINA	28	
RALPH S JOHNSON	33	75
RESOLUTE WPC 620	31	49
RIGOLETTO	11	11
RIO TUJPAN	2	
ROSE CITY	13	73
RUTH LYKES	17	85
SAN HOUSTON	3	
SAMUEL S	5	
SANROSUN	23	
SANTA MARIA	39	17
SANTO AMARO	3	
SEALAND COMMERCE	38	116
SEALAND FINANCE	45	81
SEALAND MCLEAN	54	117
SEALAND TRADE	58	115
SEATRAIN LEXINGTON	44	159
SEATRAIN YORKTOWN	60	165
SEPTA	4	
SHIRLEY LYKES	12	1
SILVERLINE		39
SHAUGRAN		42
SNOW STORM	6	31
SONGKHLA	15	
STADT BREMEN	41	
STARWARD	43	43
STOLT LION	1	
STUYVESANT	24	77
SUNWARD	22	122
SVENDBORG MAERSK	28	63
T L KENZEN	2	
TAMPA	29	73
TAURUS		87
TEXACO FLORIDA	9	
TEXACO WISCONSIN	3	6
TFL DEMOCRACY	37	115
THOMAS LYNCH	3	62
THOMPSON PASS	15	23
TOHAMI MARU	101	48
TOYOTA MARU 12	71	94
TRETN MAERSK	19	
TYSLA	1	
UNION HARVEST		93
UNIVERSE KURE	22	155
VAN TRIUMPH	22	125
VEMA	1	
VOLNAY	32	
WESTERN EXPRESS	17	94
WILLI REITH	85	
WINTER WAVE		24
WORLD MEDAL	24	28
WORTH	31	43
YOUNG AMERICA	18	69
ZENLIN GLORY		5
ZIM NEW YORK	25	
ATPN	31	67
BLEL	13	69
D8WL	5	39
D8CH	4	33
D5NW	62	84
D7BE	4	61
ELOC	16	9
GMPU		33
H2DN	12	2
HGGJ		58
INGD	1	3
JJBD	19	11
KFSH		28
KHLO	13	26
KSFH	54	143
LCPH		27
LICS	7	
NDCY	8	15
SFAH	8	54
SLED		23
T6IB		15
WZ20		18
WRJG		32
WTUG		12
ZCKD		5
0YBB		4
3EOU	16	16
5LOT	31	41
5MIK	28	12
6ZLN		34
9MTB	54	111
9VVD	43	34

SHIP NAME	VIA RADIO	VIA MAIL
MARIAS TAG-87		189
MASON LYKES	23	53
MAUMEE	3	17
MAYAYAN KEEPER		31
MEDIOLANUM	7	
MENINA ALICE	38	66
MIDAS RHEIN	2	33
MINERVA	5	
MING SUMMER	2	
MOBIL POWER	8	32
MOBILGAS	18	43
MONTERREY	4	
MORMACALTAIR	4	
MORMACLYNX	27	78
MORMACSKY	17	142
MORMACVEGA	3	34
MOZART FESTIVAL	15	
NAVASOTA		82
NEW JERSEY SUN		4
NOPAL LANE	34	
NORDIC PRINCE	38	
OCEAN HAPPINESS	17	
OGDEN CONGO	34	151
OJI GLORIA	12	
ORCO TRADER	17	87
ORIENTAL EXECUTIVE	15	42
ORIENTAL STATESMAN	17	72
OVERSEAS CHICAGO	4	17
OVERSEAS ULLA	4	
PACBARONESS	9	
PACGLORY	11	
PACIFIC EXPRESS	67	35
PACIFIC VENTURE	42	104
PACMAJESTY	7	
PACQUEEN	8	
PAN WESTERN		25
PEIRCE	4	
PHILADELPHIA	39	71
PINE SKY	9	
PIONEER CRUSADER	37	67
PORTUGAL MARU	24	37
PRESIDENT FILLMORE	47	111
PRESIDENT JOHNSON	57	135
PRESIDENT PIERCE	77	167
PRESIDENT TRUMAN	51	99
PRINCE WILLIAM SOUND	33	66
PURE OIL	24	90
QUIRADA	47	19
RED ARROW	12	78
REVERE		61
RIO LOS SAUCES		16
ROBT. E LEE	4	24
RUSEVILLE	3	
S P LEE	31	41
SAN RAFULANGIE	4	
SAN JUAN	49	121
SANSINENA II	7	44
SANTA MARIANA	35	87
SARGODHA	15	43
SEALAND CONSUMER	39	101
SEALAND GALLOWAY	30	27
SEALAND PIONEER	21	130
SEALAND VENTURE	38	44
SEATRAIN ORISKANY		85
SEAWAY	21	47
SEVEN OCEAN		38
SHUNKING	48	115
SINCERE NO 3	38	47
SKYWARD	7	
SNOWLAND	30	21
SOUTH LIGHT	1	
STADT DIEPPE	8	46
STATE OF TRIPURA	30	44
STOLT LLANDAFF	34	133
SUCCESSFUL VENTURE	21	
SURVEYOR	57	104
SWEETBRIER WLB 403	8	
T L PEDERSEN	1	
TANEY WMEC 37		21
TENA STAR	1	
TEXACO GEORGIA		7
TEXAS	7	43
THOMAS E CUFFE	57	139
THOMAS MAERSK	1	
TILLIE LYKES	58	139
TONCI TOPIC	5	58
TOYOTA NO 24	29	16
TRIUMPH	21	4
TYSON LYKES		57
UNIQUE FORTUNE	9	12
VALLEY FORGE	58	95
VAN WARRIOR	49	127
VICENTE GUERRERO	5	
WALTER RICE	39	131
WESTERN SUN	1	24
WILLIAM H. ALLEN	3	
WISTERIA		4
WORLD PRIDE	7	
WYMAN TAG-534	1	
YOUNG SEAGULL	33	8
ZIM GENOVA	17	43
ZIM TOKYO	44	58
ATSI	21	49
D8QH	44	110
D9AL		137
D5ES	39	51
D5QC	22	121
D7SF	15	
ELFH	4	20
GPHU		39
H6DT	3	52
HJAS	29	60
IBRH	1	14
JR8X	8	14
KSBD	20	15
KHML		14
KSLJ	35	105
LCYH	20	116
LIOL		68
WHWP		28
D7UO		29
SFYV	78	167
S6ED	18	28
WB2B	2	31
WFQE	13	156
W5MB	7	63
WY33261		7
ZCKV	75	86
3EBH	6	22
3EXC	17	33
5LUB	54	140
8MJE	97	176
6ZMN	39	84
9VHD	81	96
9VYT	17	47

SUMMARY: GRAND TOTAL VIA RADIO 24575 GRAND TOTAL VIA MAIL 51834

Rough Log, North Atlantic Weather

December 1979 and January 1980

ROUGH LOG, DECEMBER 1979--The primary storm track came across southern Canada by way of the Great Lakes. The track then continued eastward to Newfoundland and across the water to Scotland. Many of the storms could be traced to the Pacific. Several LOWs wandered over the water between Kap Farvel and Iceland. There was a secondary storm path over Hudson Bay, but most storms dissipated before reaching the shipping lanes. The major difference between the paths of the cyclones this month and climatology was the absence of a branch of the primary path from Newfoundland into Baffin Bay.

The mean sea-level pressure pattern was not vastly different from climatology. The Icelandic Low at 989 mb was normally located near 63°N, 30°W, but 11 mb deeper than normal. A secondary LOW over the Norwegian Sea was not present. The Azores High at 1026 mb was shifted about 600 mi east of its normal 1021-mb location to about 200 mi southwest of Lisbon.

The major sea-level pressure departure centers were collocated with the pressure centers. A minus 12-mb anomally was centered near 62°N, 30°W, and a plus 6-mb center was over southern Portugal. The United States and Europe south of latitude 50°N both had higher pressure than normal.

The upper air pattern at 700 mb showed a major trough southwestward from a LOW over southern Greenland and paralleling the east coast of the United States. This was an anomalous LOW southeast of the primary LOW over Devon Island. The primary LOW was 83 m deeper than the climatic normal. The upper-air winds were primarily zonal across the ocean between latitudes 30° and 60°N.

Wave climatology shows a large area south of Iceland where there is a 50-percent chance of waves greater than 12 ft. A smaller oval area within that area shows a 15-percent chance for waves over 20 ft.

Extratropical Cyclones--A trough deepened as it moved off the New England coast, and a 1010-mb LOW formed south of Cape Sable. On the 3d the EL PASO ARZEW found 45-kn winds near the trough line. The LOW was racing northeastward under zonal upper-air flow. There was strong southwesterly flow ahead of the storm and its front from latitude 40°N to Scandinavia. Ships and platforms in the North Sea were being hit by winds up to 55 kn. The DRUPA at 61°N, 01°W, had 50-kn winds and 23-ft waves. At 1200 on the 4th the 968-mb LOW was near the Faeroe Islands. Ireland and western England were ripped by gale-force winds. At 0000 on the 5th the PLAT (62°N, 0°W) reported 83-kn winds with 39-ft seas. Others had 50- to 60-kn winds with one calling the seas 43 ft. By 1200 the storm was 948 mb near 69°N, 11°E. The winds were decreasing over the North Sea, but OWS Mike measured 40 kn during 21-ft seas. A station on the Norwegian coast appeared to report 45 kn. For such a deep storm, it was still moving very fast. Twenty-four hours later it was over northern U.S.S.R. and no longer threatening Atlantic shipping.

As the storm above raced ahead, it left this small LOW behind on the 3d. The JADRON (39°N, 34°W) in the southwesterly flow between the two LOWs had 52-kn winds on the 4th. On the 5th several ships had winds near storm strength in the vicinity of 40°N, 27°W, with waves up to 20 ft.

By 1200 on the 6th the LOW was 994 mb slightly west of OWS Romeo. The CHAMPAGNE off the coast of Portugal had 50-kn winds. Romeo had 35-kn winds and 23-ft seas, while a ship south of the center had 25-ft swell waves. Early on the 8th the LOW dissipated over the North Sea.

As a LOW rushed into the Labrador Sea on the 7th, a frontal wave formed over the St. Lawrence River. The southwesterly flow ahead of the front was already well established, and the MAIZURU MARU found 40-kn gales near 40°N, 58°W. By 1200 on the 8th the storm was 960 mb near 54°N, 36°W. The AMERICAN LEADER (46°N, 37°W) found 55-kn winds and 30-ft waves. The SEA-LAND RESOURCE was some distance west (40°N, 56°W) with only 45 kn, but her swell waves were also 30 ft.

On the 9th there were many reports of winds in the 40- to 50-kn range. OWS Romeo measured 40 kn with 30-ft seas. The high winds and waves continued into the 10th. The RUBENS (47°N, 31°W) was buffeted by 58-kn winds and 33-ft seas.

On the 10th the primary LOW turned northwestward as another LOW broke off and continued eastward and a frontal wave was moving through the southern part of the storm. On the 11th the LOW disappeared off Greenland.

A frontal wave raced eastward over the Great Lakes on the 9th. It was over Nova Scotia on the 10th. The 0000 analysis of the 11th showed a double LOW with the southern one destined to be the potent one. At that time the FORT CALGARY had 45-kn gales accompanied by 21-ft seas and 30-ft swells. The MARJORIE LYKES at 42°N, 52°W, was nearby with 50-kn winds and 21-ft waves. At 1200 the LOW was 986 mb near 48°N, 37°W (fig. 42). The RUBENS (46°N, 35°W) radioed an en-

Figure 42.--This afternoon ascending satellite shows a graphic presentation of the west edge of the clouds along the cold front.

counter with 70-kn winds and 25-ft waves, while the WESTERIA (44°N, 41°W) called the winds 60 kn and the waves 30 ft. The high winds and waves continued into the 12th with several reports of winds over 60 kn and waves as high as 39 ft. The storm passed very near OWS Lima about 1800.

On the 13th the storm was 958 mb near 61°N, 15°W. The AMERICAN ARCHER recorded a minimum pressure of 959 mb as she sailed through the storm (fig. 43), but her maximum winds were only 40 kn. She did manage seas and swells up to 30 ft for over 24 hr. OWS Lima was severely mauled, measuring winds as high as 75 kn and waves up to 49 ft. The ships and platforms on the North Sea were faring little better. The LOW was moving northward, and on the 14th slightly westward. A frontal wave was moving eastward along latitude 50°N and weakening the flow to some extent. The winds were now in the 40- to 50-kn range, but there were many wave reports near 30 ft and one of 39 ft at 54°N, 32°W. The storm moved over Iceland on the 14th and another system took over on the 15th.

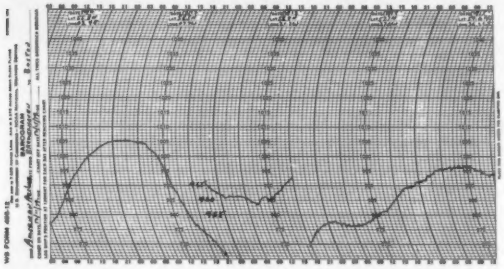


Figure 43.--The weather package sent by the AMERICAN ARCHER included not only this barogram trace, but their observations, forecasts, and facsimile charts.

This continuation of the storm was the frontal wave mentioned earlier. By 1200 on the 14th it was 974 mb near 54°N, 17°W. Several ships sent observations of near 50 kn and waves over 30 ft. OWS Romeo measured 44 kn and 33-ft seas. At 1800 the NIPPON MARU (49°N, 12°W) quoted 60-kn winds and 49-ft seas and swells. Three hours later Romeo had 39-ft seas. The Bay of Biscay and the North Sea were hard hit. Winds with gusts to 85 kn and torrential rains hit southern England according to the automobile club. Trees were uprooted, roads blocked, and flooding reported. Coastal areas may have had winds up to 100 kn.

Many ships were in trouble, especially fishing vessels. The 3,338-ton SKOPELOS SKY broke up on rocks off the north Cornish coast. Some of the ships involved (in no particular order) included the HERMOD, TURGUT REIS, RIO BRANCO, EAGLE, STEPHAN JANTZEN, FENRIS, OBORG, ATRIA, MAGALI, ARINKA, HEYE P. BRITISH UNITY, LINA VON BARGEN, BLENHEIM, MANOR PARK, SAINT PATRICK, NIELS HENRIK ABEL, MINGARY, NYBORG, GEORGIOS TSAKIROGLOU, and the TRANSDENIZ.

At 1200 on the 15th the 970-mb LOW was near 55°N, 05°E. Gales were still hitting the United Kingdom. As the LOW moved over the Baltic Sea, it deteriorated rapidly, but a new storm was moving over northern Scotland on the 16th and 17th. This one was 962 mb at 0000 on the 17th. The KLJAFOSS (56°N, 06°W) reported 68-kn winds with many others in the 50- and 60-kn category. The waves reported were not nearly as high as might be expected, only 20 to 25 ft. There was one report of 39 ft by the ZARIA near 54°N, 02°E. As the storm moved over Scandinavia, it weakened.

This frontal wave was identified on the 13th over the Smoky Mountains. By 0000 on the 15th the 992-mb storm had raced to 45°N, 52°W. There were a few gale reports. On the 16th the ATLANTIC COGNAC at 49°N, 44°W, had 74-kn winds from the northwest. The storm passed south of Lima about 0600, and at 1200 she had 55-kn winds and 28-ft seas. Others were measuring seas and swells to 33 ft. At 1800 Lima measured 58-kn winds. The North Sea was hard hit again by this storm, with winds up to 60 kn and waves to 39 ft. The pressure was 960 mb as it passed over the Orkney Islands. The storm quickly disintegrated as it passed over the Baltic Sea.

This was a fast-developing storm. It was first analyzed on the 1800 chart of the 16th over western New York. It moved eastward until late on the 17th, when it collided with a slow-moving, large HIGH which was blocking the normal storm track. Three ships were caught in the tightening gradient between the two pressure systems with winds near 60 kn. They were the ALERT (39-ft waves), ORJEN, and ZIM HAIFA.

As the storm turned northward it deepened rapidly from 996 mb to 970 mb in 12 hr at 0000 on the 18th. The island of Miquelon measured 50-kn winds. The SUNEMERILLON added its name to those with 60-kn winds.

On the 19th the storm passed through the Davis Strait. Two ships in the strait had winds of 56 and 60 kn; two land stations measured 40 kn, one on each side of the strait from opposite directions. The LOW continued up Baffin Bay to disappear on the 20th.

To get back to that large HIGH. It started out over the central United States on the 14th and traveled eastward slowly increasing in strength. At 1200 on the 15th it crossed the East Coast at 1036 mb. Its center moved along latitude 42°N until turning northeastward on the 17th. By 1200 on the 19th it was 1047 mb near 50°N, 23°W. It was quite a large HIGH for a maritime one. Its anticyclonic influence was felt from latitude 15°N to 75°N and longitude 45°W to 05°E.

On the 20th a LOW formed over Denmark Strait, pulling a front against the northwest quadrant, and the HIGH started retreating southward with the pressure falling. By the 23d it had reached a more normal 30°N latitude and 1026-mb pressure.

This was a series of LOWs that formed and dissipated between Greenland and Iceland. On the 20th a LOW was analyzed over Scoresby Sound. A station on the northwest tip of Iceland measured 40-kn winds. On the 21st the weather station on the icecap at 65°N quoted a 40-kn wind and a -34°C temperature. On the 0600 analysis the LOW had suddenly jumped about 300 mi south.

On the 22d the KRPAN (56°N, 40°W) had 60-kn winds and the icecap station also had 60 kn with the temperature now -38°C. Later in the day at 1800 the KRPAN (55°N, 41°W) had 68-kn winds and 20-ft seas. The 970-mb LOW was slowly drifting eastward with a small southerly component. As the large HIGH moved south-

ward, the cyclonic circulation expanded with a loosening of the gradient.

The SAARBRUECKEN was in Denmark Strait on the 23d with 52-kn northeasterly winds. The LOW wandered around the area until the 26th, when another center formed and moved off to the Baltic Sea.

This was a short-lived Mediterranean storm. It began as a heat LOW over Algeria and traveled northward over the Algerian coast. It was 988 mb at 1200 on the 21st. A desert station had 40-kn easterly winds, and a ship off Barcelona had 40-kn northerly winds. On the 22d several ships on the Mediterranean reported 40-kn winds, and one reported 50 kn off Constantine. Coastal land stations were also measuring 40 kn (fig. 44). On the 23d the LOW was over northern Italy as another formed north of the Alps.

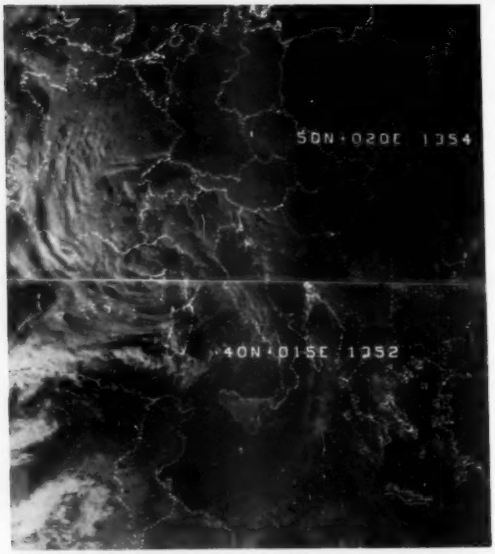


Figure 44.--The clouds with this system are thin except in the northwest quadrant as the desert air would be dry. It appears to be more of a wind storm.

As the LOW dissipated, a strong trough remained bringing strong winds and high seas to the Italian coast. Nine ships were reported aground near Naples. In addition, six small coasters were damaged and a floating dock and hydrofoil were described as semisunk at their moorings. The 6,399-ton EASTERN EXPRESS went aground off the port of Carrara. Other ships in difficulty were the CRETAN REEFER towed by the tug ENGLISHMAN, the MICHALIS, PINE FOREST, and STAVROS S.

This series of frontal waves and small LOWs badly damaged the United Kingdom. The 0000 chart of the 26th showed a deep LOW near Iceland with a trough extending southward over the Irish Sea. There were two weak LOWs near latitude 40°N in the central ocean. By 1200 the trough had developed into a front, and the two LOWs were traveling northeastward along the front. The gradient east of the front became very tight. Coastal stations were reporting winds up to 35 kn on the 27th. Heavy rains accompanied the storm, especially as the waves moved along the front. Ships in the Bay of Biscay and observing platforms in the North Sea measured winds of 50 kn and greater with waves of 20 to 25 ft. The GYOS reported swells of 36 ft in the Bay of Biscay.

The night of the 27th some 2,000 people were evacuated from their homes in South Wales because of the storms and flooding. Two hundred people were rescued from a mobile home park in Dorset. Destruction was widespread. At least 10 people were dead. A cargo jet crashed when it was hit by a strong wind gust during landing at Heathrow airport. The crew was rescued.

Some of the ships that appeared to be involved in the storm and had damage of various types were the AEGIS CAPTAIN, BUNGA PERMAI, CARO, DAMIAN, HASSEL, LION, MARATHA MARINER, and WINN HELLESKOV. The barge INTERMAC 600 broke from tow of the GULF MAJESTY and grounded at Cornwall. On the 28th the front moved over the North Sea and the weather conditions improved rapidly. The 15,673-ton ferry TOR SCANDINAVIA was forced aground on the coast of Sweden by high winds.

The last significant storm of the month had its origin over the U.S. Midwest. It crossed the coast on the 26th with an isolated gale being reported. The storm almost immediately turned northward and started to intensify. On the 27th the YOUNG AMERICA (fig. 45) found 45-kn winds and 21-ft seas southwest of the center. The first new wind-powered cargo ship, the JOHN

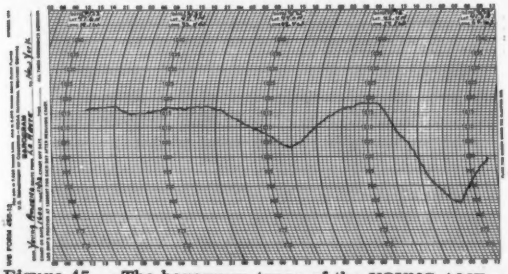


Figure 45.--The barogram trace of the YOUNG AMERICA shows her pressure dropped sharply to 984 mb and was on a corresponding sharp rise.

S. LEAVITT (front cover), sank 280 mi southeast of Long Island on the night of the 27th as she took on water in 20-ft-high waves (fig. 46). Air National Guard helicopters rescued the crew. She was on her maiden voyage with a load of lumber for Haiti.

Several ships had winds near 40 kn on the 28th. The CGIO (45°N, 52°W) had 50-kn winds. Late in the day the CANADIAN OWL (40°N, 64°W) had 44-kn winds with 39-ft seas and swells. On the 29th the NANT sent two reports of winds of 50 kn.

On the 30th the 975-mb LOW was near Belle Isle. A small LOW was moving around the southern periphery. The C.V. LIGHTNING (41°N, 60°W) found 26-ft swells. The winds were in the 40- to 50-kn range, but the fetch had increased many swell-wave reports over 20 ft and some over 30 ft. On the 31st a ship

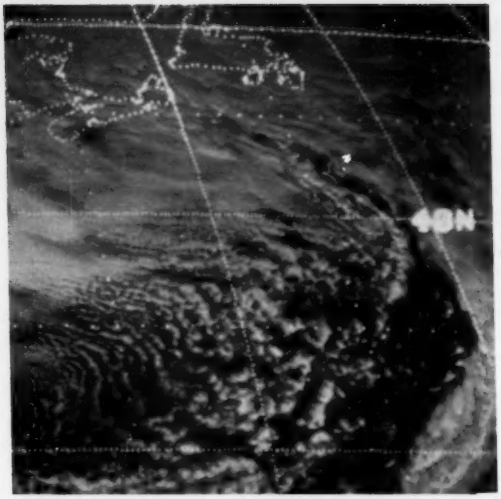


Figure 46.--At 1700 the storm was centered near Sable Island. The cloud streaks off the East Coast are indicative of unstable conditions.

near 43°N, 55°W, radioed that they were being pounded by 43-ft waves. At 1800 the GRONLAND, south of Kap Farvel, was beaten by 68-kn northeasterly winds and 49-ft seas.

The winds reported on New Year's Day were relatively light, but several ships had waves over 20 ft and up to 26 ft. By late on the 3d the storm was gone.

Casualties--The motor vessel MALMI sank in strong winds in the Baltic Sea. Two yachts sank on the 7th and 8th. Four women from the SHADOW were missing, but the nine crewmembers from the DESPERADO were saved. Five people were injured when the 1,672-ton HOLGER DANSKE and the 191-ton SUNDBUSS JEPPE collided in fog outside Helsingborg. The dredger TITAN and TROY grounded off Atlantic City during strong winds. The West German SCHARZWALD 191 and the tank barge MIVA ROMANTICA collided in fog on the Waal.

The 14,433-ton ARYA SEPEHR and the 2,620-ton ADMIRAL ARCISZEWSKI made contact in Falmouth Bay during force 11 winds gusting to force 12. The 5,465-ton PRINCE OF BRITTANY sustained storm damage from St. Malo to Portsmouth on the 10th.

A barge 400 ft long and weighing 10,000 tons unloaded broke from its tug in force 9 winds and 30-ft waves on the 13th in the North Sea. It was recaptured on the 14th much to the relief of oil field personnel. The tug JANE HOAGLAND collided with the tug JIM COLLINS in fog on the Mississippi River. The HILDEGARD PETERS (3,927 tons) requested heavy-weather damage survey at Rouen.

The 8,895-ton KATHERINE and CRAZY HORSE collided upon emerging from a fog bank near Gibralter. The 11,163-ton SERAFIN TOPIC was blown onto a sandbar at Baltimore by high winds on the 17th. The 11,757-ton DEFIANCE reported heavy-weather damage on the 17th and 18th. Seven crewmen from the GULSTAV TRADER were rescued after the vessel struck shoreline rocks during a storm. The LERT sank off Ushant on the 20th after her cargo shifted in

Figure 47.--The Great Lakes freighter E.M. FORD carrying 7,000 tons of previously dry cement lies partially submerged at Milwaukee. Wide World Photo.

bad weather. The crew was rescued. The 7,285-ton BENARTY was surveyed for heavy weather damage at Brest on the 21st. The Canadian laker HOCHELAGA was blown aground in Sandusky Bay. The 15,035-ton TAMARA GUILDEN sustained heavy-weather damage on voyage from Amsterdam to Philadelphia. The E.M. FORD (4,538 tons) broke loose from her moorings and was battered against the dock during 52-kn winds on Christmas Eve and Christmas Day (fig. 47). The SOULA G. sank in heavy weather off the east coast of Greece on the 25th. Six crewmen were feared drowned.

The BALINTAWAK allegedly lost an anchor and chain in Mar Grande Roads in heavy weather on the 31st. The PHENIX was abandoned in strong glaes in the Ligurian Sea and sank.

Other Casualties--The 5,077-ton SUDELMAR II dragged anchors at Montevideo during 50-kn winds and drifted onto mudflats on the 30th. The 700-ton PASSAAT CURACAO took water into her holds containing sulfur on a voyage from Willemstad to Buenos Aires.

ROUGH LOG, JANUARY 1980--Fewer major cyclone centers than normal traversed the North Atlantic this month. The primary track followed climatology fairly closely from the Gulf Coast and off the Atlantic Seaboard to about latitude 40°N. At that latitude the paths fanned out and spread from due north toward the Labrador Sea to northeastward toward the Norwegian Sea. There was a well-defined track across the Great Lakes, but most storms dissipated before reaching the Labrador Sea in accordance with climatology. An average of one cyclone a week visited the Mediterranean.

The monthly mean sea-level pressure chart showed the 999-mb Icelandic Low shifted southwestward from its normal position to near 57°N, 48°W. There were two major troughs out of the LOW, one paralleling the East Coast and the other southward along longitude 40°W. The Azores High was near normal at 1020 mb.

The primary negative anomaly center was 6 mb between Newfoundland and Kap Farvel. A broad lesser negative area was associated with the two troughs. Of importance to the weather and reflecting the lack of storm centers passing over the Greenland and Norwegian Seas was a large positive anomaly over that area.

The upper-air pattern as reflected by the 700-mb level indicated zonal flow between latitudes 30°N and 50°N. There was an anomalous closed-LOW center over the Labrador coast near Hopedale. The normal ridge over western Europe was accentuated over Iceland.

According to wave climatology there is a large area between latitudes 40°N and 60°N where the probability of having waves equal to or greater than 12 ft is 50 percent.

Extratropical Cyclones--The first significant storm of the month began in a shallow LOW off the Carolinas on the 1st. On the 2d the AMERICAN RANGER found 50-kn winds and 20-ft waves near 34°N, 66°W. On the 3d the winds increased to 65 kn and the waves to 23 ft. The storm was growing, and at 1200 it was 976 mb at 39°N, 58°W (fig. 48). Other ships were now being included, and the SEALAND PACER fought 60-kn winds and 33-ft waves near 40°N, 59°W. On the 4th the DART EUROPE (50°N, 43°W) and MARGOT JACOB (42°N, 54°W) both had winds of 60 kn, with the latter contending with 39-ft seas. Many other ships had winds and seas in the 40- to 60-kn and 20- to 30-ft range.

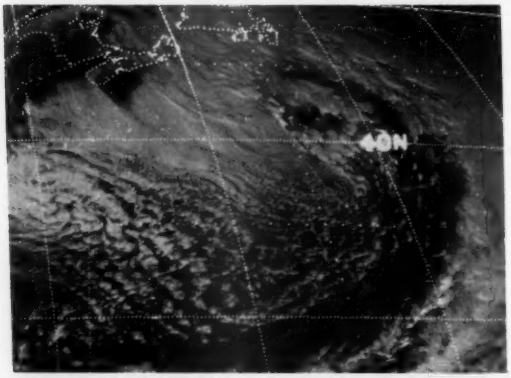


Figure 48.--At 1800 the surface center was near 44°N, 55°W. Using the technique described in the article on page 83, I estimated the pressure as 975 mb. The analysis indicated 968 mb.

The storm was on a northerly track and on the 5th was between Cape Race and Kap Farvel. Winds over 50 kn continued south of the center, and waves up to 25 ft were found as far south as latitude 37°N.

On the 6th the LOW was moving northward up the west coast of Greenland. Another large LOW moved northeastward off Nova Scotia and absorbed the circulation south of 55°N.

The LOW was over Davis Strait on the 7th. It generated 45-kn winds on the icecap. The FRITHJOF was near Godthab with 72-kn downslope winds and 23-ft waves. The DISKO was west of Kap Farvel with 44-kn winds. The storm continued northward over Baffin Bay and then turned southwestward over the islands.

This storm developed over the Gulf Coast on the 4th. On the 5th it was traveling northeastward along the Gulf Stream. The GYPSUM COUNTESS (40°N, 72°W) had 45-kn winds from the northeast. Other ships reported gales. At 1200 on the 6th the storm was 984 mb near 41°N, 58°W. The ship with the highest wind and wave report was the EL PASO SOUTHERN (35°N, 64°W) with 50 kn and 41 ft. Late on the 6th another LOW developed in a trough of this circulation and sped off to the east as this one raced northeastward. On the 7th a ship near 45°N, 43°W, found 50-kn northerly winds with 20-ft waves. Charlie measured 40 kn with 20-ft seas. The storm was nearing the King Frederik coast of Greenland on the 8th. Lima was now under its influence and measured 50-kn winds. There was a 25-ft wave report at 45°N, 40°W. At 1800 the BERGLIND (57°N, 36°W) was on the 990 isobar with 63-kn winds. On the 9th a storm out of Quebec added a shot of energy to this storm as it was absorbed. The BILDERDYK was near latitude 51°N on the 10th with 45-kn winds. Charlie had 20-ft waves. The LOW had stalled near 62°N, 40°W, on the 8th. It was now deteriorating rapidly and disappeared on the 12th.

A frontal wave developed on the front out of the above storm on the 8th. It started and ended with a bang, but there was not much in between. The INCOTRANS SPEED (33°N, 43°W) was west of the 1006-mb center with 45-kn winds and 20-ft waves. A ship north of the center and front in the northerly flow had 36-ft swell waves.

On the 9th the pressure increased and there were only minimal gales. The LOW wandered northwestward and almost disappeared on the 11th, but a cold front from another LOW brought new energy to the storm which started intensifying again on the 12th. The USNS COMET was west of the center with 44-kn winds and 20-ft waves.

On the 13th the EL PASO ARZEW, about 150 mi south of the 984-mb LOW, and another ship 100 mi west had 60-kn winds. Neither reported waves. By noon at Greenwich the winds were about the same, but the waves had picked up. Ships in all quadrants had waves over 20 ft, and the CINULIA within 6 mb of the center on the eastern side had 36-ft waves.

The storm, blocked by two high-pressure cells to the north, was slowly weakening. There were still a few gales being reported and an occasional wave up to 20 ft on the 14th and 15th. The LOW disappeared from the analysis on the 16th.

A front stretched across Florida into the Gulf of Mexico, and waves were moving along it starting on the 12th. On the 13th one of these was unstable. With the aid of energy from the Gulf Stream it started expanding. By the 15th the 1004-mb LOW was off Cape Hatteras (fig. 49). Several ships had gales over 40 kn and the NANT (40°N, 70°W) had 60-kn northeasterlies. These increased to 65 kn on the 16th with 30-ft waves. By 1800 they had decreased to 40 kn, but the swells were still 30 ft. The NANT was doing a marvelous job of reporting.

At this time a cold HIGH was pushing eastward over Quebec and forced the storm eastward and then southeastward. Early on the 17th the ARGONAUT (38°N, 60°W) was treated to 68-kn winds but didn't venture out in the dark to check the waves. The NANT now had 59 kn and 30-ft swells.

On the 18th the central pressure was starting to increase and the gradient relaxed with a marked decrease in windspeeds. The LOW, now not a storm, continued drifting southeastward, then eastward to oblivion.

This storm had a long history and was the only one to come across southern Canada and survive to enter the Atlantic. It started its journey on the 13th over Lake Winnipeg. It crossed the Labrador coast on the 15th and was almost directly over Kap Farvel on the 16th. Its forward motion slowed, and the storm expanded. On the 18th winds over 40 kn were observed with Charlie measuring 45 kn with 23-ft seas. The persistent northwesterly winds were building the swell waves, and at 1800 Charlie had 30 ft.

On the 19th the LOW was 980 mb near 60°N, 26°W. The SELFOSS (66°N, 23°W) was being pounded by 52-

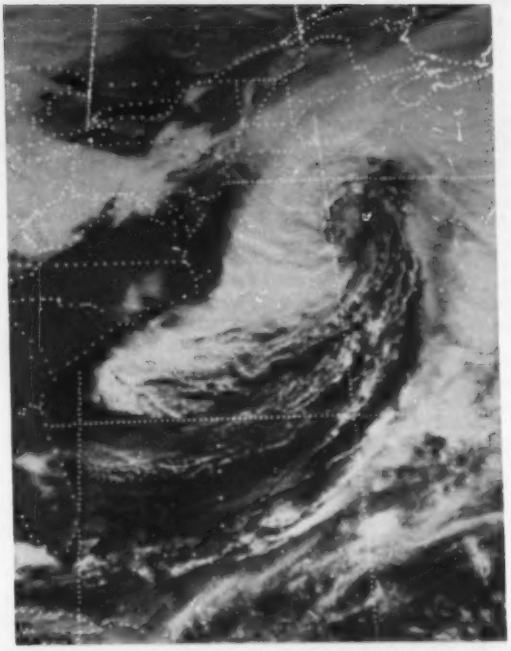


Figure 49.--The storm was off Cape Charles at 1700 on the 15th.

Figure 50.--The tanker REGITZE THORSTRUP is shown aground on the coast of Ireland. A rescue helicopter hovers overhead. Wide World Photo.

kn winds. On the 20th the higher waves had arrived at Romeo at 20 ft. Late in the day a maverick LOW raced eastward along 52°N and wiped out this storm.

Although the storm changed centers, this LOW was a continuation of the total meteorological and storm system. On the 0000 analysis of the 20th a trough connected the above LOW with one off Nova Scotia. By the 1200 analysis a 984-mb LOW had formed in the trough and was traveling eastward. It was generating gales and 20-ft seas. On the 0000 chart of the 21st the LOW north of Romeo brought her 30-ft waves. At 1200 the 964-mb LOW was over the Irish Sea (fig. 50). Forty- to fifty-knot winds and seas over 20 ft were common in the North Sea. The SOLON TURMAN in the Bay of Biscay radioed a 75-kn wind and 33-ft wave report. A ship near Lands End said the waves were 43 ft, and another in the Bay of Biscay called the waves 49 ft.

The storm had slowed in its northeasterly movement and was weakening on the 22d as it stalled near Edinburgh. By the 23d the weather had calmed to almost normal.

On the 22d a storm was moving across the Great Lakes. When it was near Ottawa a LOW formed off Cape Cod and preempted the circulation. At 1200 on the 24th the 964-mb storm was over Cabot Strait. The ALGOSEA was off Delaware Bay with 52-kn winds. The JOHN CABOT off Cape Sable on the 25th had 73-kn westerlies and 34-ft seas. Later, two ships had 39-ft waves. At 1200 the central pressure hit a fantastic low pressure of 942 mb (fig. 51). The frontal system had moved ahead of the storm and was two-thirds of the way across the ocean. The circulation extended south to latitude 30°N and east to longitude 20°W. On the 26th the winds were basically 40 to 50 kn, but the PIONEER CONTENDER (41°N, 65°W) found 68 kn. A ship near 47°N, 52°W, had 38-ft seas.

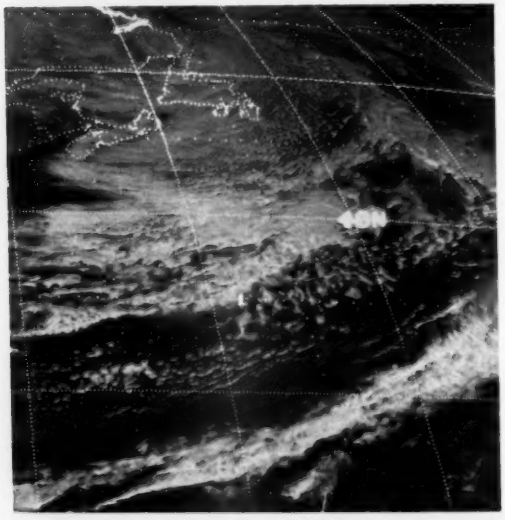


Figure 51.--The surface analysis indicated the storm centered near 53°N, 53°W, at 1700. This is difficult to verify in this photo due to the Sun angle and curvature of the Earth.

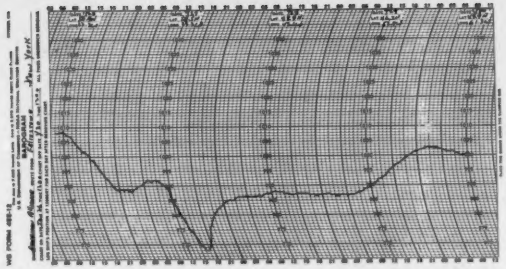


Figure 52.--The AMERICAN ALLIANCE passed directly through the center of one of the small LOWs about 1630 on the 27th.

On the 27th small LOWs started forming in the vast circulation (fig. 52). This broke up the symmetry of the system and started the decay process. The PIONEER CONTENDER still located 58-kn winds, and other ships found seas over 30 ft. The central pressure was building and relaxing the gradient, but there were still swell waves up to 30 ft far southeast of the center. The LOW had been meandering in the area of 55°N, 50°W, and disappeared late on the 30th.

This was one of the LOWs associated with the breakdown of the storm above. It traveled along the Gulf Coast as a frontal wave, continued eastward along latitude 35°N, and then turned northeastward on the 29th. It was still only a minor disturbance, but late on the 30th it exploded off the Bay of Biscay. It deepened 20 mb in 24 hr. At 1200 on the 31st it was 974 mb over the Irish Sea. There were many reports south to Cabo Finisterre of winds over 50 kn. The PRINCESS ANNE took the prize though with 65 kn near Lands End. Her waves were 33 ft. The C.S. ALERT, 180 mi to the south, had 33-ft seas and 49-ft swells. By February 1, the storm was over the Baltic Sea and no ship reports were available. Three ships received damage in the Bay of Biscay--the ATLAS, DANIA, and OCEAN ENDURANCE.

Along with the small LOWs and frontal waves rotating through and around the large storm centered north of Newfoundland were trough lines. As one of these swept eastward on the 29th, part of the trough was left behind, and a center formed near 35°N, 65°W. It was 988 mb at 0000 on the 31st and 964 mb at 1200 near 49°N, 42°W. The NURNBERG EXPRESS (47°N, 40°W) with a pressure of 971 mb was braving 64-kn winds and 36-ft waves. Another ship closer to the center had only 30 kn. On February 1, the BASHKIR (51°N, 37°W) supported 62-kn winds and 39-ft seas. Of the reports at 0600, and generally they are scarce, four had wave reports of 30 ft or more. Late on the 1st the storm weakened, and by the 3d it was gone.

Casualties--The following ships encountered heavy weather and suffered damage during the first part of the month: the BILL CROSBIE, DR. ADNAN BIREN, EASTERN TRADER, EN GEDI, FOREST STREAM, GENCLIK, IRISH OAK, KING RICHARD, MARIA P. MILOS MATIJEVIC, NEDA, OCEANIC WINNER, SALISTE, SALTERSGATE, SPRAGUE CAPELIA, and the STOLT FILIA. Eight crewmen abandoned the tug A.W.

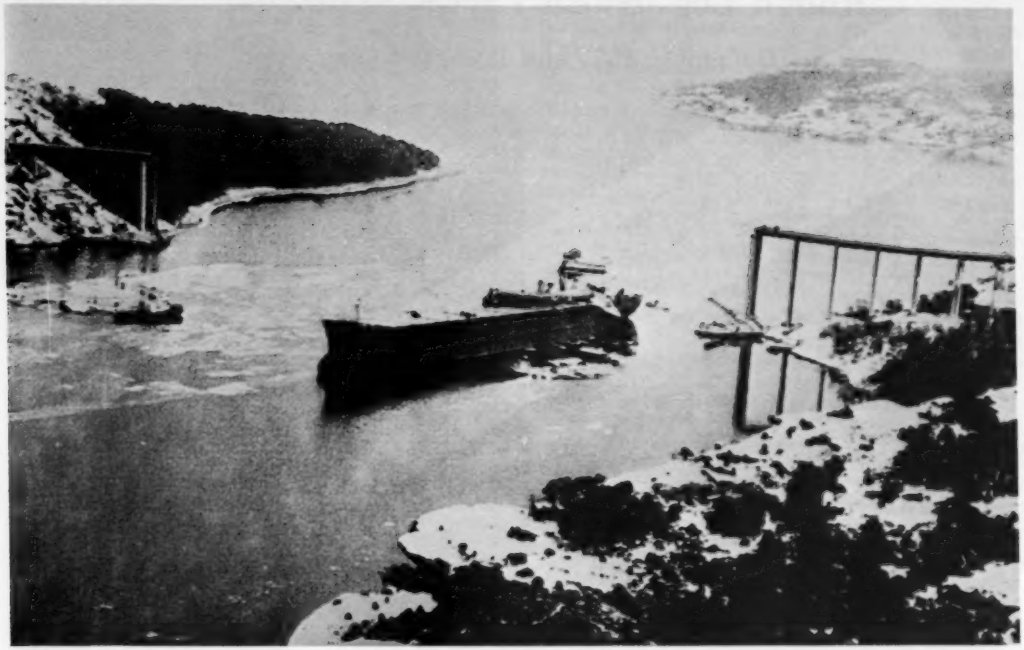


Figure 53.--This dramatic photograph shows the damaged STAR CLIPPER with part of the bridge lying across her and the Alno Bridge with the center span missing. Wide World Photo.

GUILL when its steering failed and a 456-ft container barge slammed into it off Cape Hatteras. The crewmen spent nearly 5 hr in a liferaft buffeted by 30-ft waves. On the 10th the FEDERAL ST. LAURENT at Quebec was unable to use her anchors due to icing. The research vessel ICE LADY was blown aground off of Tromso on the 15th. Four of five crewmen died when their liferaft capsized.

On the 4th the 10,076-ton BUENOS AIRES II and the DIRA RIPARIA collided in fog off Helegoland Island. Two crewmen were missing. The ORWELL FISHER (1,374 tons) and the PINEWOOD (1,599 tons) collided in thick fog near Belfast on the 11th. Other collisions in fog included the ELAN and TEKA and the NEREIDA and WYSPIANSKI in Brunsbuttel Harbor on the 16th and the BRISAS DEL NORTE and the NONI off Santona. The 24,332-ton empty tanker CEPHALONIA gored the 3,901-ton freighter LORD FRONTENAC in fog 5 mi off Galveston Bay on the 22d.

The 18,000-ton Liberian STAR CLIPPER rammed into the Alno Bridge, which is 30 mi north of Gothenburg, in dense fog on the 18th (fig. 53). The entire 500-yd-long span collapsed. Six cars and one truck fell over the edge before the bridge could be closed. Eight lives were lost.

The tanker TEXACO CARDIFF rescued eight crewmen from the CARMEN R. after her cargo shifted and she foundered in heavy weather near 12°N, 74.5°W.

Other Casualties--The 1,397-ton PEP ICE ran aground on a reef in Mozambique Channel, and stormy conditions hampered rescue of the crew. A rescue lifeboat was swamped, and the nine men were rescued by the PEP ICE. The research vessel SEISMIC EXPLORER lost 3,400 feet of floating cable 65 mi off Rio Gallegos, Argentina, in force 9 to 10 winds.

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

Rough Log, North Pacific Weather

December 1979 and January 1980

ROUGH LOG, DECEMBER 1979--The low-pressure centers did not follow climatology as well as the sea-level pressure pattern. A storm track that originated over Japan split south of Kamchatka, with one branch going into the Bering Sea and the other continuing eastward to midocean. A second track started northwest of the Hawaiian Islands and went into the Gulf of Alaska. A third track originated northeast of the Hawaiian Islands and moved onto the coast near Vancouver Island.

The mean sea-level pressure chart was almost an overlay of the climatic chart. There were two centers in the Aleutian Low, 1000 mb south of Valdez and 1002 mb in the vicinity of the Near Islands. These pressures matched climatology exactly as did the 1020-mb Pacific High near 30°N, 130°W.

The largest anomaly was minus 4 mb near 40°N, 145°W, associated with a deeper-than-normal trough out of the Gulf of Alaska Low. There were several areas of plus 2 to 3 mb.

The upper-air flow was mostly zonal across the water. There were the usual troughs along the Asian coast and west of the North American coast. There was an anomalous trough along longitude 165°E.

Typhoon Abby and tropical storm Ben cruised the western ocean.

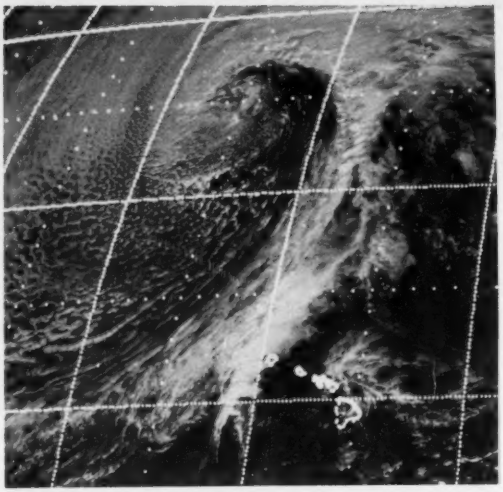


Figure 54.--This satellite image verifies the surface analysis almost exactly.

Extratropical Cyclones--Frontal waves had been moving along a front that stretched from southeast of Hawaii to Washington State. The SANKO MAPLE was north of the center of cyclonic circulation on the 4th with 40-kn winds and swells of 30 ft. At 1200 there were two low centers. The WDAO found 50-kn winds and 25-ft waves and the MANUAWILI 40-kn winds and 25-ft swell waves, both northwest of the centers. By the 5th the northern center had consolidated the circulation. The BRINTON LYKES was now in the 50-kn wind band with 26-ft waves. Another ship also found 26-ft waves.

The storm had been moving westward, but curved northward on the 5th. Maximum winds of near 40 kn were being reported on the 5th and 6th. On the 7th the WILD MARLIN found 25-ft swells. The storm was weakening and was gone by the 8th.

This storm blossomed between 1200 on the 7th and 0000 on the 8th northwest of Hawaii. At 1200 on the 8th three ships had 50-kn winds in the vicinity of 34°N, 168°W. The BRINTON LYKES was one of these and reported 33-ft waves. At 1800 the NORDPOL found 60 kn and 39-ft waves near 34°N, 168°W. At 0000 on the 9th the 993-mb LOW was near 35°N, 165°W (fig. 54). Three ships had winds of 60 kn or greater. The highest waves were 36 ft. At 0600 the LOUISE LYKES was stationary with 55-kn winds and 39-ft waves. The HAKUSAN MARU reported 49-ft swells near 39°N, 168°W. The LOW was weakening on the 10th and disappeared on the 12th.

When this LOW was analyzed on the 10th off Hokkaido it appeared insignificant. It was following a fairly strong storm. By 0000 on the 11th it was still only a dent in the larger circulation, but two ships to the southwest felt 45-kn gales. The OCEAN DUKE, about 500 mi to the south, had 39-ft swells.

The storm must have conserved its strength for a strong push during the next 12 hr. Its pressure dropped 17 mb as the older storm turned westward. Several ships felt the bite of 50-kn winds and 20- to 26-ft waves. The STELLA LYKES (35°N, 162°E) came up with 55-kn winds and 41-ft waves on the 12th. On the 13th two ships along longitude 169°E had winds over 60 kn and three had waves over 30 ft.

On the 13th the old storm again became the primary surface storm as realinement occurred in the upper air. This LOW filled, turned westward, curved to the south and then eastward to dissipate. The old new storm jogged southward on the 13th and 14th. The SPRUCE became involved with 75-kn winds and 33-ft swells on the 14th near 43°N, 171°E, not far from the center. The SHINZUI MARU (52°N, 163°E) was north of the center with 58-kn easterlies, 25-ft seas, and 41 ft swells.

The LOW was breaking into multiple centers on the 15th, but there were still high waves and strong winds in the southern half of the circulation. Late on the 15th one of the newly formed centers dominated the circulation.

This was that new center of circulation. It was one of the centers that formed on the 15th as the old circulation was breaking down. A new closed center had formed out of a trough in the upper air and sapped the energy of the older circulation. At 0000 on the 16th the center was 958 mb near 42°N, 157°W (fig. 55). In

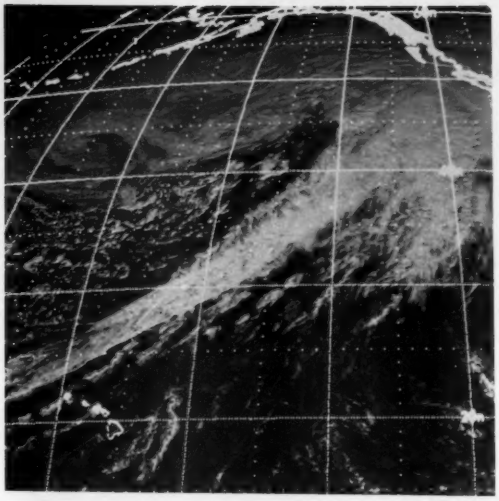


Figure 55.--Close examination indicates a "C"-shaped brighter cloud near the storm's center at 46°N, 147°W, at 2045.

general terms this storm covered the entire North Pacific from coast to coast and as far south as latitude 20°N. That day there were three ship observations of near 70 kn and more with waves over 30 ft. The CGC MELLON found 40-kn winds and 26-ft seas south of Unimak Island at 1200.

Early in the day on the 17th a ship near 45°N, 140°W, fought 58 kn with relatively low waves for that speed of wind. Others with slower windspeeds found over 30-ft waves. The SEALAND MCLEAN was very near the center at 1200 on the 17th, 958 mb versus 952 mb for the center by analysis (fig. 56). Being close to the center, the winds were relatively light. Late in the day the OVERSEAS CHICAGO (57°N, 137°W) contended with 55 kn, 33-ft seas, and 39-ft swells. On the 18th the cyclonic circulation still reached almost to Japan, but there were now two LOWs. This storm was over the Gulf of Alaska and weakened rapidly as it moved ashore.

This storm was a combination of several LOWs which formed and dissipated. Although there were different

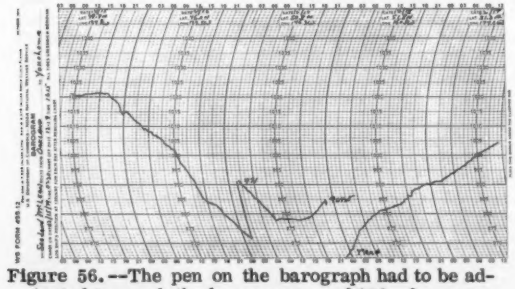


Figure 56.--The pen on the barograph had to be adjusted to reach the low pressure of 958 mb encountered by the SEALAND MCLEAN.

surface centers, the same meteorological system was involved. The initial center formed over Hokkaido on the 15th. By 1200 on the 16th it was only 992 mb, but it was generating strong gales in the southwest quadrant with waves near 20 ft. At 2100 on the 17th and 0000 on the 18th, two ships had winds near 50 kn. On the 19th the center was 970 mb near 43°N, 173°W. A frontal wave had formed in the southeast quadrant and was about to become the primary storm on the 20th. The ORIENTAL IMPORTER was north of a sharp trough with 41-ft northerly swell waves.

As the frontal wave moved into the Gulf of Alaska, another LOW formed north of Kodiak. The OCEAN LOG complained of 64-kn winds near 50°N, 160°W, and she continued to have high winds into the 22d.

On the 21st the frontal wave moved into the mountains and was soon gone. The Kodiak LOW persisted with gales occurring along the Canadian coast. The storm stalled near 59°N, 144°W, and slowly died.

This initial storm came out of Manchuria. It crossed into the Sea of Okhotsk on the 20th, where it paused until the 22d. After crossing Kamchatka on the 23d it rapidly consolidated four small LOWs. The CHARLES LYKES had 42-kn winds near 50°N, 177°E. An unidentified ship nearby found 25-ft waves. A quick shuffle took place on the 24th as the storm shifted centers. At 1200 on the 25th the 950-mb storm was over Bristol Bay. On the 25th most of the higher winds were in the 40-kn category. There were many 40- to 50-kn winds and 20- to 30-ft waves on the 26th. Late on the 26th and on the 27th the storm started falling apart and had accomplished this by the 29th.

This LOW originated in the mid-Pacific and traveled eastward. It really did not become a storm until the 23d and was spent by the 25th. At 1200 on the 23d the 976-mb center was near 48°N, 137°W. At that time there were a few winds over 40 kn, but by 1800 they had really picked up. Three U.S. tankers caught 54- to 63-kn winds, but the waves were light. The swells picked up to 30 ft on the 24th with the PRESIDENT GRANT finding 35-ft swells. The West Coast was hard hit with winds gusting to 80 mi/h near San Francisco. Early on the morning of the 25th the LOW disintegrated as it approached the coast.

Where there was only a trough at 0000 on the 26th, there was a full-blown storm at 1200 near 46°N, 167°E. A Japanese ship was unlucky and was caught in 45-kn winds west of the center. On the 0000 call-in on the 27th there were four ships with winds straddling 60 kn. Waves were building to 25 ft.

The 28th brought many 40- to 50-kn winds and 25- to 30-ft waves. The THAMES MARU recorded 58-kn winds, 26-ft seas, and block-busting 46-ft swells far to the south of the 964-mb center, which was near 44°N, 156°W, at 1200 (fig. 57). The storm was relatively circular, and there were winds close to 50 kn in all quadrants on the 29th. The PHILADELPHIA (53°N, 134°W) to the northeast of this storm had 70-kn winds and 34-ft waves with an intense mini-storm that lasted less than 24 hr. At 1800 a SHIP near 35°N, 150°W, reported 55-kn winds with 39-ft seas and 49-ft swells.

The storm weakened on the 30th and curved northwestward. It curved back northward and died on Jan-

Figure 57.--At 0052 on the 28th the LOW was 972 mb near 45°N, 163°W, at the surface with the upper-air center near 46°N, 164°W.

uary 2.

This storm barely made the month; in fact, the severe weather waited for the New Year. The story begins off Honshu on the 30th. By New Year's Eve (Z time) it was celebrating with gales, and one ship north of the center had 33-ft wave companions. On the 1st the storm turned northward for a better alinement with its upper-air support. The ORIENTAL SOVERIGN was north of the 970-mb storm fighting 45-kn winds and 30-ft waves.

In the meantime an interloper was fast approaching from the west. This center took the spotlight on the 3d. It brought innumerable gales driving high waves with it in the westerly flow, where the fetch was already established. The BODENA (32°N, 168°E) was unlucky to be in that place at that time as she reported 33-ft seas and 66-ft swells.

By 0000 on the 4th the 960-mb storm was centered on 180° at 48°N. The BODENA now had 49-ft swells.

The storm was traveling northward with the gradient loosening. On the 6th it was over the Bering Sea.

Tropical Cyclones, Western Pacific--Typhoon Abby was first spotted on the 1st just north of Kusaie at the eastern end of the Caroline Island chain. She reached tropical-storm strength between Kusaie and Ponape. Once north of Ponape Abby headed toward the west-northwest.

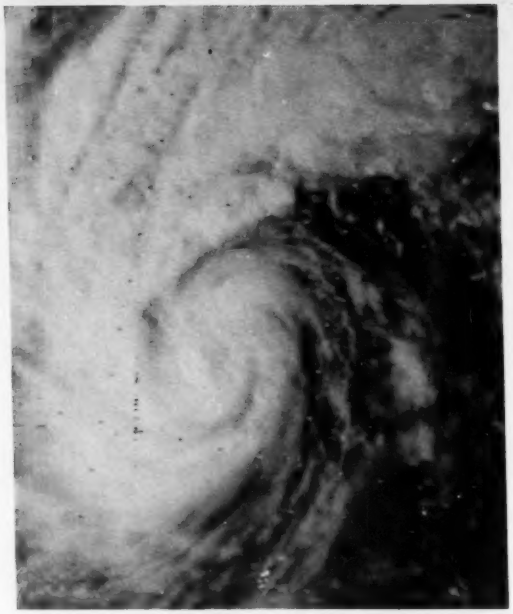


Figure 58.--Abby was approaching typhoon strength at this time early on the 10th.

Her maximum winds climbed to 60 kn northeast of Truk on the 5th. However, she weakened and after passing south of Guam on the 8th fell back to depression strength. However, that was not to be the last of Abby. She began to reintensify as she recurved. By the 10th winds were up to 60 kn again (fig. 58). The following day she reached typhoon strength and winds climbed to near 90 kn as Abby crossed the 15th parallel near 130°E. Her peak was 100 kn on the 12th and 13th as she accelerated east-northeastward on her parabolic route. South of Iwo Jima Abby began to fall apart. By late on the 14th her central pressure rose to 1001 mb, and she was turning extratropical; winds fell to below gale force.

Tropical storm Ben popped up as a depression just off the coast of Samar on the 21st. Moving west-northwestward through the central Philippines, Ben quickly reached tropical-storm strength. On the 22d he emerged into the South China Sea. Maximum winds climbed to 55 kn by early on the 23d. However, Ben was recurving on a track that took him across northern Luzon. The rugged terrain took its toll, and Ben was finished by the time he reentered the Philippine Sea.

Casualties--The barge ZB-1801 sustained heavy-weather damage while being towed from Portland to Seattle on December 9 and 10. The 21,467-ton container vessel PRESIDENT MADISON requested heavy-weather survey on arrival at Yokohama. The 9,983-ton SANTO VICTOR encountered heavy weather with damage on a voyage to Busan. The 12,498-ton AEGIS TOPIC had damage to the superstructure on a voyage from Prince Rupert to Tomakomai. The 15,744-ton GOLDEN MISTRAL also was damaged on the way to Japan. The SAN GEORGE reported weather damage at Yokohama.

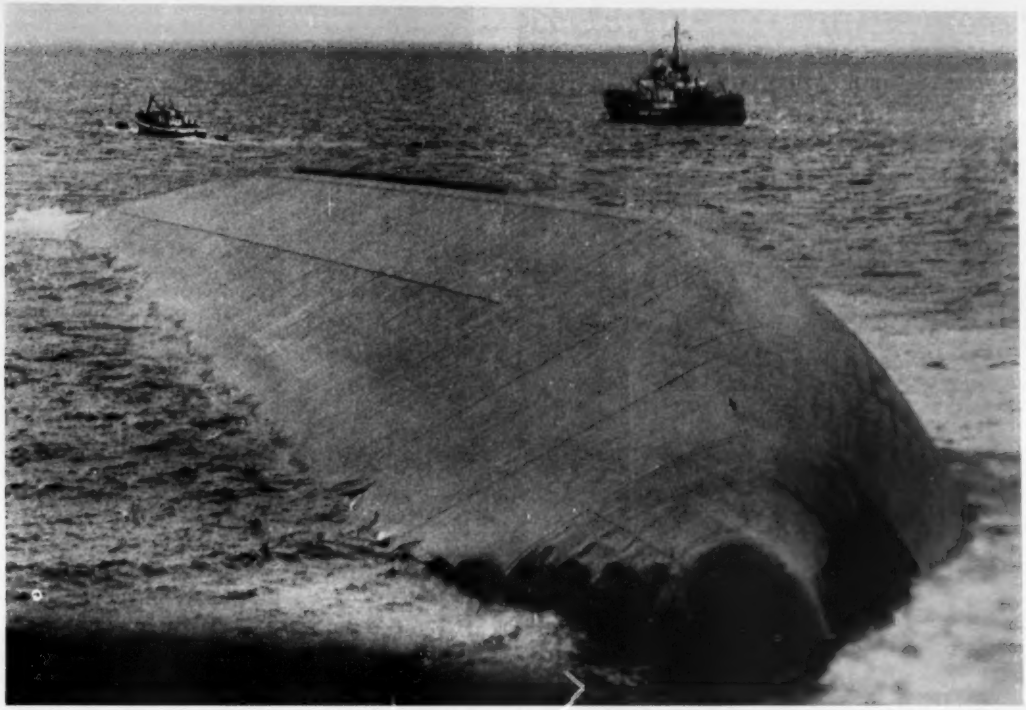


Figure 59.--The capsized LEE WANG ZIN is being towed to sea, where it sank in deeper water. Wide World Photo.

The TRANSCHAMPLAIN (7,647 tons) broke her moorings at Hunters Point during a storm on the 23d. The 33,461-ton HONGJIN sank in heavy weather near 36.7°N, 155.8°W. The crewmembers were rescued by the YASHIMA MARU. The 15,528-ton LEE WANG ZIN capsized 20 mi northeast of Rose Point in the Queen Charlotte Islands on the 25th in gale-force winds and high seas. All crewmen were lost (fig. 59). The 18,246-ton ITEL VOLANS was due Yokohama on the 26th with weather damage. The 13,766-ton ore carrier JAG JIWAN was damaged due to weather during the 21st to 31st enroute to Tsintao.

The barges AGATTU and KONA broke loose from the tug SENTINEL in bad weather and grounded near the entrance to San Francisco Bay on the 31st. The CHU FUJINO arrived Honolulu on January 2 with heavy-weather damage.

ROUGH LOG, JANUARY 1980--The cyclone tracks were scattered across the ocean after they turned northward or northeastward. The only favorite path was from Japan eastward prior to curvature.

The Aleutian Low at 998 mb was within 1 mb of climatology, but it was 10° latitude farther south than normal near 40°N, 180°. The Pacific High was 1017 mb near 25°N, 125°W, versus 1020 mb according to climatology and 300 mi southeast of its normal position.

There were four anomaly centers of importance. Two were negative and basically associated with the displacement of the Aleutian Low. One center was minus 9 mb near 39°N, 173°W, and the other was minus 10 mb near 35°N, 145°W. The two positive centers were plus 11 mb over eastern Siberia and plus 4 mb over the Gulf of Alaska near 52°N, 140°W.

The upper-air flow at 700 mb was mainly zonal between latitudes 20° and 40°N from the Asian coast to about 170°W. The primary LOW was over the Sea of Okhotsk. The ridge that is normally over the North American west coast was shifted westward over the water.

Wave climatology shows an area of about 4° latitude and 15° longitude centered on 50°N and 165°E, where the probability of encountering waves of 12 ft or greater is 40 percent and of 20 ft or greater 10 percent.

Extratropical Cyclones--This LOW formed at the point of occlusion of a front east of Honshu. It intensified very rapidly, and by 1200 on the 5th ships were reporting high winds and waves. A Japanese ship near 34°N, 147°E, in the northerly flow had 40-kn winds and 33-ft waves. At 1200 the META had 45-kn southerly winds which had shifted to the north at 1800 at 55 kn with 33-ft seas and 39-ft swells.

There were three LOWs alined north-south at about longitude 160°E on the analysis of 0000 on the 6th, and this was the center one. A ship near 39°N, 164°E, had

50-kn winds with 30-ft seas and 33-ft swells. By the 1200 analysis this LOW had been squeezed out between two high-pressure cells.

As the above LOW disappeared, the southern one became the storm to contend with. At 0000 on the 7th it was 994 mb at 33°N, 174°E. There were high winds and waves on both sides of the front, which stretched north-south from 60°N to 15°N. The PACIFIC VENTURE found 52-kn northerly winds with 26-ft waves, while a ship near 45°N, 167°E, had 36-ft waves from the east.

This was an odd storm that acted like a large frontal wave. The fronts across the ocean were different also as three of them looked like graceful "S" curves. High pressure was building over the Bering Sea--1048 mb on the 8th. The easterly flow south of this HIGH penetrated south of latitude 40°N (fig. 60). The SEAWAY CLIPPER, west of the storm, had 48-kn winds and 30-ft waves. On the 8th the storm died as another center formed farther to the east.

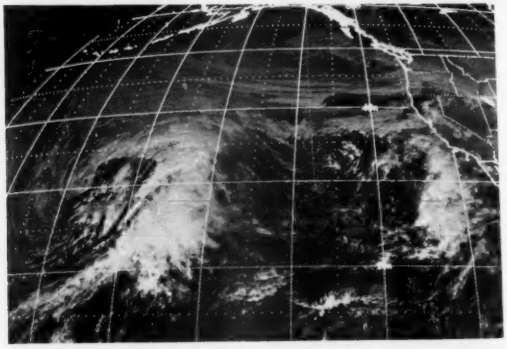


Figure 60.--This stationary satellite image at 2045 on the 8th depicts the strong easterly flow south of the HIGH over the Bering Sea and two storms. The one that hit Hawaii is near 31°N, 167°W, and the other that hit Seattle is near Cape Flattery.

This storm center came into being as two others on each side deteriorated on the 8th. By 1200 on the 9th the storm was 978 mb near 34°N, 160°W. The strong circulation south of the center brought high winds and large amounts of rain to the Hawaiian Islands. Though ship reports did not reflect the high winds, there were reports of hurricane-force winds in the Islands and nearly 6 in of rain. The higher winds may have been partly caused by funneling effects and on mountains. It was reported that trees were uprooted with damage to electric and telephone services. The storm was directly responsible for five deaths, two in the crash of a cargo plane in Honolulu and three on the island of Hawaii. Twenty-foot waves pounded the south and west shores. Boats were damaged and swamped and shore homes damaged. The highest wind report by a ship in the vicinity of the Islands was 45 kn by the VELMA LYKES on the 10th. That day the storm was moving northward against the strong easterly flow from the large HIGH, which was now centered over the Arctic Ocean. Several ships northeast of the center had 40- to 50-kn winds with waves to 30 ft. By the 11th the storm had disappeared as a frontal wave arrived from the northwest to continue the overall cyclonic circulation.

This storm squeezed into the Pacific Northwest between two large high-pressure cells, one over the Yukon Territory and the other off Vancouver Island. The LOW moved southeastward along the coast out of the Gulf of Alaska and was over Vancouver Island on the 8th at 1006 mb. It was not a deep storm, but it dumped up to 14 in of snow along the Oregon-Washington coasts. It came close to paralyzing Seattle and Portland. Many roads were closed and motorists stranded. It was reported that 125 small boats sank, and numerous roofs collapsed. Rain in southern California caused mudslides and flooding. The PRESIDENT MADISON found 50-kn winds from the northeast near 53°N, 142°W. Early on the 10th the LOW moved inland.

This LOW formed on the 8th near 38°N, 163°E. It moved into the circulation of the storm that hit Hawaii and reinforced it. On the 9th the winds with the storm were not so high, but there were many reports of swell waves of 20 ft or greater. The ESSO PROVIDENCE at 42°N, 158°E, reported 46-ft swells. To the south a ship near 29°N, 167°E, had 52-kn and 26-ft seas.

The LOW was near 33°N, 170°W, at 1200 on the 10th at 976 mb. There were winds of 40 to 50 kn associated with it. The PORT VANCOUVER (34°N, 175°E) had 45-kn gales and 33-ft waves on the 11th. The KISO MARU found 52-kn winds and 23-ft waves. Early on the 12th the ANCC EMPRESS was sailing southwestward into 50-kn winds and 20-ft waves. At 0600 on the 12th the SEA-LAND MCLEAN must have passed directly through the center with a pressure of 955 mb (fig. 61). The LOW disappeared a few hours later as a large storm built over the Gulf of Alaska.

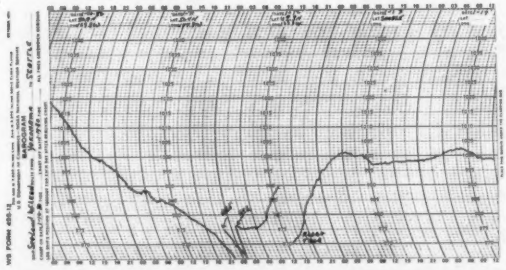


Figure 61.--The barograph of the SEA-LAND MCLEAN graphically demonstrates the depth of the storm.

This storm formed in an inverted trough off Kyushu on the 9th. By the 10th there were gales, and on the 11th the NICHIRIN MARU had 45-kn winds and 33-ft swell waves near 34°N, 150°E. At 0000 on the 12th the LOW was 976 mb near 40°N, 163°E. The PENNSYLVANIA RAINBOW was not far away (37°N, 162°E) with 60-kn winds, 20-ft seas, and 36-ft swells. At 0600 the swells increased to 46 ft. On the 13th it was the PORT VANCOUVER's turn to battle 44-ft swell waves near 34°N, 168°E. The waves in the southwest quadrant were holding better than the winds. On the 15th the LOW was weakening, but 20- to 30-ft swells persisted. On the 16th it finally gave up.

This LOW formed over the Gulf of Alaska on the 10th in the wake of the storm that brought all the snow to the Pacific Northwest. By the 0000 report of the 11th ships between 49°N and 55°N near the coast were reporting strong gales with waves near 25 ft. On the 12th the CGC CLOVER near Cape Flattery had 60-kn winds and 20-ft waves from the southeast. At 1800 that day OWS Papa measured 68-kn winds. Stations on the British Columbia coast were measuring over 40-kn winds. The gradient was tightest over the mountains.

On the 12th another LOW moved into Queen Charlotte Sound and absorbed the first one. This one brought 60 mi/h wind gusts along the coast from northern California to Washington. The MOBIL MERIDIAN had 50-kn winds but only 15-ft waves off Port Alice on the 13th. As this storm moved inland, yet another LOW formed near Kodiak Island. The pressure was 962 mb at 1200. Cape St. James measured 40-kn winds.

This LOW remained nearly stationary until it disappeared on the 17th.

This storm formed on the 15th in a trough associated with a LOW that moved northward over the Kurile Islands. By 1200 a ship about 400 mi to the southwest found 26-ft swell waves. By 1200 on the 16th the 966-mb storm was near 45°N, 178°W. The ALCYONE (40°N, 171°E) had 60-kn winds with no wave report, but she later reported weather damage. The DIAMOND PHOENIX (41°N, 176°E) had 54 kn and 30-ft seas. The latter ship's winds continued over 50 kn until the 17th, and she now had 39-ft seas. At 1200 the winds were 45 kn and the seas 33 ft. She was traveling with the storm at about the same speed and relative position to the center.

The LOW had turned northeastward and left most of the stronger winds south of latitude 40°N and east of the front. A strong HIGH was over British Columbia bringing strong southerly flow between the two centers (fig. 62). The SANKO MAPLE was one of the southern ships with 45-kn winds, 33-ft seas, and 49-ft swells. Several other ships had waves of 20 to 25 ft. The OCEAN DUKE (53°N, 152°W) was in the southerly flow with 50 kn and 30-ft waves. On the 18th a small LOW split off north of this one and continued northward, while this storm curved southeastward to disappear.

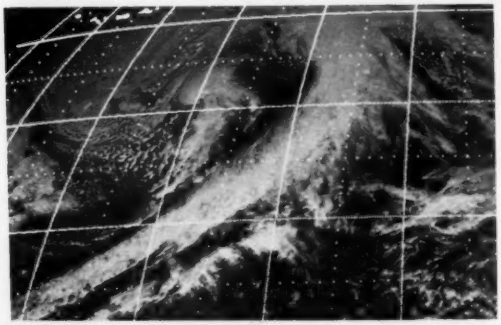


Figure 62.--The primary storm center was near 46°N, 165°W, with indications of a transient circulation near 40°N, 160°W.

This LOW came out of China as a 1022-mb indentation in a 1041-mb HIGH. It gained strength as it moved over the Sea of Japan. On the 17th the TOYOTA MARU No. 11 had 30-ft swells near 34°N, 147°E, just east of the cold front. Twelve hours later a ship in the same relative position to the front had 28-ft waves.

The LOW traveled almost due east. At 1200 on the 18th it was 984 mb near 41°N, 167°E. The winds were in the 40-kn range, but the waves were raging to 30 ft and more. On the 19th two ships had winds near 60 kn west of the center. Twenty- to thirty-foot waves were common.

On the 20th the storm started curving northward. The BONNIEWAY (39°N, 177°E) had crossed north of the storm and had 55-kn winds about 900 mi southwest of its center. The CGC RUSH was riding 55-kn easterly winds near 54°N, 159°W. The storm crossed the Alaska Peninsula late in the day and finally was lost on the north slope.

This was another LOW that developed at the frontal occlusion. A fair-sized storm with gales was moving northeastward along the Kurile Islands. The frontal system had rotated some distance to the east of the storm. The 1200 chart of the 23d first indicated the new closed circulation. At that time a SHIP about 300 mi east of the new center (981 mb) indicated 55-kn winds.

Within 12 hr the new storm (965 mb) was deeper than the parent one. The SEALAND FINANCE (50°N, 165°W) was in 60-kn southeasterly winds with 20-ft waves. Another ship, the H8DF, found 26-ft waves near the new point of occlusion. Nine other ships had winds over 40 kn.

Early on the 25th the storm was about to move ashore on Siberia as three ships were still reporting swells over 23 ft. Later in the day this storm dissipated as another moved into the area.

As a LOW moved northward over Kamchatka it left an area of weak gradient to the south. This could not last long as nature is prone to change things. A closed LOW was found at 0000 on the 27th. At 1200 it wasn't much

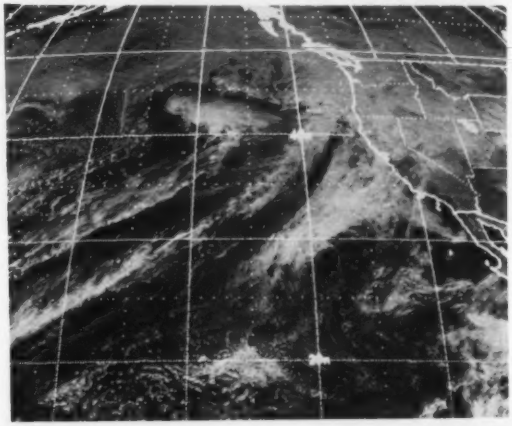


Figure 63.--The front has piled up against the West Coast north of 40°N. Two troughs are outlined by distinct cloud lines west of the front.

of a storm, but by 0000 on the 28th things had changed. The pressure had dropped to 976 mb. The surface storm had become alined with an upper-air cutoff LOW and was now a complete system. The winds were in the 40's, but two ships, the SURUGA MARU and TYSON LYKES in the vicinity of 28°N, 173°E, both found 30-ft waves out of the northwest. The LOW had originally moved southeastward but had turned northeastward. Later in the day the NISSAN MARU (33°N, 172°E) had 60-kn winds, and the ARNOLD MAERSK (38°N, 175°W) had northeasterly 70-kn winds. On the 29th the SEA-TRAIN PRINCETON (30°N, 173°W) was contending with 64 kn. The seas were generally up to 20 ft, but the SEA-LAND PIONEER (33°N, 172°E) found 30-ft swells.

The higher winds continued around 40 kn and the waves 20 ft as the storm continued toward the Gulf of Alaska. Some of the higher waves were now in the northwest quadrant near the Aleutians. The storm's cyclonic circulation now covered most of the northeast quarter of the ocean. On the 31st the ASIA BOTAN (48°N, 143°W) said the winds were 68 kn and the waves 30 ft. At 1200 a ship reported 60-kn winds and 62-ft waves near Vandura, Saskatchewan, Canada. At 1800 the report from Papa indicated 82 kn, but I question that speed. Her pressure was 972.8 mb near the 965-mb center, and the rest of the observation appears good (fig. 63). On the 1800/01 and 0000/02 reports a SHIP indicated near 60-kn winds within 4 mb of the center, so Papa may have been right. Her waves were 31 ft.

On the 2d a following LOW became the circulation center and on the 3d yet another. On the 4th another storm moved in.

From small frontal waves, large storms grow. This was the case of this small wave on a front south of Kyushu on the 29th. By 1200 on the 30th the 981-mb storm was northeast of Tokyo with a secondary center over the Sea of Japan. Several ships reported high gales, including the THANA VAREE (41°N, 150°E). On the 31st a Japanese ship (45°N, 159°E) encountered 53-kn easterly winds and 20-ft waves. Closer to the islands the 5,130-ton HATSUFUJI sank in heavy seas in the Sea of Japan after taking on water. One crewman was rescued. The motorvessel SHINEI MARU sank in blizzard conditions, again only one crewman was rescued. A ship south of the storm had 30-ft waves.

On February 1 the gravel carrier TAISEI MARU capsized in Osaka Bay. The 2,993-ton FLAMINGO had a 20-degree list south of Tokyo in heavy seas. The CYNTHIA G. out of Yokohama with 2,000 tons of steel had a heavy list and engine trouble after cargo storage collapsed in heavy weather. The crew was rescued by helicopter.

The storm center continued northward, but another LOW developed to the south and ships in that area were pounded with strong gales and waves of 20 to 35 ft. These continued into the 2d, but by the 3d the weather moderated, and by the 4th the LOW was only a trough.

Casualties--The yacht GOOD SHIP INDIA sank in heavy weather on the 1st in the Mediterranean. Six persons were rescued by the STAHLECK. Two barges towed by the tug MOANA HOLO parted their towline during heavy weather on the 5th about 1,200 mi from Honolulu and

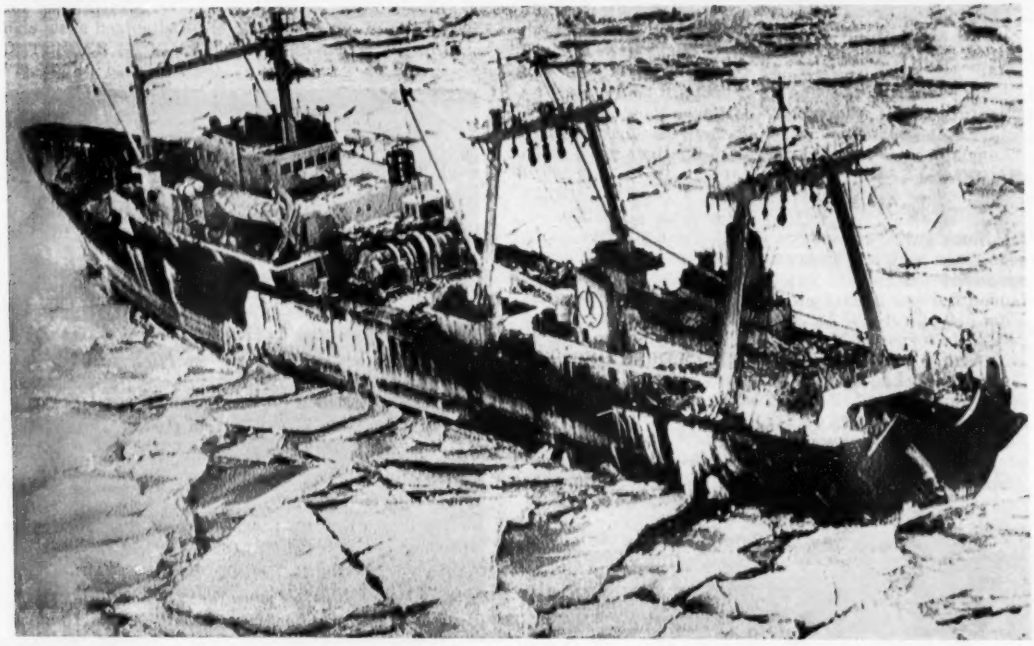


Figure 64.--The trawler GAE YANG near St. Matthew Island is coated with ice and hemmed in by broken ice floes. Wide World Photo.

collided. The AGIOS GIORGIS sank in heavy seas about 560 mi east of Tokyo. No trace was found of the 29 people on board, although lifeboats were reported as being launched. The 33,461-ton Korean HONGJIN was reportedly listing badly in stormy seas on the 10th. The 3,429-ton GRAND UNION had heavy-weather damage during the 7th to the 12th.

The two Korean fishing vessels GAE YANG and GAE CHEONG HO No. 2 were trapped in ice near St. Matthew Island in the Bering Sea on the 14th (fig. 64). The cutter STORIS went to the rescue. The fishing vessel GEMINI was reported sunk near 56°N, 148°W, on the 16th from the buildup of heavy ice. The 2,992-ton ALEX sank in the Sea of Japan on the 22d after being washed by a high wave. Only 2 of 21 crewmembers were rescued. The NGTRANS II sank off Malaysia in heavy weather the night of the 26th.

The following ships also had heavy-weather damage: ALCYONE, CHU FUJINO, HAN WOO, NIHON ALPHA, OGDEN THAMES, and SOUTH GLORY. The ANCO CHARGER received flooding in heavy weather off Australia.

Marine Weather Diary

NORTH ATLANTIC, APRIL

WEATHER. During April, weather conditions over the middle and northern latitudes are generally much more settled compared to the preceding month. Thus, intervals of favorable weather are more frequent and usually of longer duration. There is a notable reduction in the frequency and intensity of winter-type LOWs. The 1007-mb Icelandic Low lies off Kap Farvel near 59°N, 41°W. The Azores High (1021 mb) is centered more than 1,700 mi farther south near 30°N.

WINDS. The prevailing wind north of 40°N is generally from the westerly quarter of the compass except over the Norwegian Sea, where winds are quite variable. Within this large belt, about 55 percent of the observations report winds of force 4 to 6. From about 40°N southward to the northern boundary of the trades, the prevailing wind is mostly southwesterly, although winds with an easterly component are prevalent off the east coast of Florida out to 70°W, and over the Gulf of Mexico. Near the coasts of Morocco and Portugal, northerly winds dominate, and westerly and northwesterly winds hold sway over the Mediterranean Sea. The winds north of the trades and south of the westerlies are weaker than their counterparts north of 40°N--only about 45 percent of all observations yield winds of force 4 to 6. The trades are more firmly entrenched in April, as compared to March. They usually prevail south of 25°N and, in the eastern North Atlantic, extend to about 30°N. Fifty to 75 percent of the time, they are force 3 to 4.

GALES. The area subject to gales decreases greatly in the middle and northern latitudes, compared to March. The most southern point of the 10-percent frequency boundary has moved northward to 53°N, 45°W. The area affected is enclosed by that point to 60°N, 15°W, to 62°N, 25°W, to 65°N, 28°W, to 63°N, 55°W, to 53°N, 45°W. A small area (about 6° square) of 10-percent frequency is centered east of the Grand Banks near 47°N, 38°W. Gales also spread over the Gulf of Lions about 10 percent of the time.

EXTRATROPICAL CYCLONES. Principal areas of cyclogenesis during the spring months (March, April, and May) are found in a broad area from Cape May down to Georgia on the United States east coast, eastnortheastward out to the central ocean, including the waters around Newfoundland. Within this region, cyclogenesis is concentrated from the coasts of Virginia and North Carolina northeastward to a point near 39°N, 66°W. Other principal areas of cyclogenesis lie around the south coast of Iceland; over most of the Baltic Sea, including Danish waters, but not including the Gulf of Bothnia; off Norway's arctic coast; over the Bay of Biscay; and over the Gulf of Genoa, the northern and central Adriatic Sea, and the southwestern Black Sea. Primary storm tracks in April are much the same as in March. One track begins about 250 mi east of Cape May and travels northeastward over the Grand Banks. The storms heading northeastward across the North Atlantic tend to pass a little farther south of Iceland than in March. Over the Mediterranean, the primary storm track reaches northern Italy, but does not extend to southern Turkey as it did in March.

TROPICAL CYCLONES have not been reported during April in the North Atlantic in over 100 years. This is the only month of the year in which no tropical storm activity has occurred.

SEA HEIGHTS of at least 12 ft are found more than 10 percent of the time north of a line extending from Labrador around the eastern margin of the Grand Banks to 41°N, 50°W, westward to 70°W. The same line curves eastward along the 36th parallel to 60°W, and then across the North Atlantic to Ireland and central Norway. Another small area of 10-percent frequency extends from the Gulf of Lions southeastward to a distance of 150 mi out over the Mediterranean. An elliptically shaped area of 20-percent frequency extends from latitude 55° to 60°N, and across longitudes 15° to 55°W.

VISIBILITY. Occurrences of low visibility increase over the western part of the North Atlantic, especially west of 40°W. The greatest change from March takes place over the Grand Banks and the waters south and east of Newfoundland, where over 20 percent of the observations show visibilities of less than 2 mi. Visibility over the Norwegian Sea has decreased in the west and increased in the east. The area of 10-percent frequency of low visibility over the North Sea has moved southwestward and extends from the tip of southern Norway to the coast of Great Britain.

NORTH PACIFIC, APRIL

WEATHER. The weather over the North Pacific generally shows marked improvement over that of any month since October. Compared to the winter months, periods of storminess are fewer, but severe extratropical LOWs are still encountered occasionally. The

Aleutian Low has filled to three 1009-mb centers along 55°N. Its configuration is that of a banana, bridging from the Gulf of Alaska to the Sea of Okhotsk. The 1012-mb isobar orientation has changed very little over the past months, except the southern boundary has moved steadily northward with spring, now approximating 50°N. The three LOWs are located just east of Kamchatka, in the middle of the Bering Sea, and in Bristol Bay. The Pacific High is expanding with two major centers near 32°N, 159°W, and 32°N, 178°W.

WINDS. Over about half of the North Pacific between 40° and 55°N, the windspeeds are of force 4 to 6 in 50 to 65 percent of the observations. The remainder of this latitudinal belt, especially near the coast of North America, experiences winds of force 3 to 5. The prevailing winds are from the westerly quarter. Between 30° and 40°N, winds are variable west of 170°E, mainly southwesterly between 170°E and 150°W, and westerly to northerly east of 150°W. Forces 3 to 5 are recorded in 45 to 70 percent of the observations. Variable force 5 winds often blow over the western half of the Bering Sea, and northerly force 5 winds are quite common over the eastern half. Easterly winds of about force 4 sweep over the northern Gulf of Alaska. South of Japan, easterly force 4 winds prevail, and winds from any direction except west and southwest are common over the East China Sea, where force 3 to 4 is the rule. The "northeast trades" prevail south of 25°N, over the western ocean between the dateline and the Philippines, and south to 30°N over eastern waters. The trades blow at about force 4, except near the Equator and over the Philippine Sea, where force 3 winds prevail. The northeast monsoon continues to dominate the South China Sea, but with less strength and steadiness than in the colder months. Winds of force 2 to 3 account for between 46 and 63 percent of all observations. Northerly winds continue to prevail south of the Gulf of Tehuantepec, but gales over the Gulf now occur less than 5 percent of the time. Force 2 to 3 winds are experienced 50 percent of the time, compared to 40 percent in March.

GALES. Two areas of high gale frequencies, 10 to almost 20 percent, persist as a residual of the winter month in the middle and northern latitudes. One holds sway over the Gulf of Alaska south of Kodiak Island to about 52°N, and eastward to near 140°W. The other is a belt 250 to 370 mi wide that lies east of Honshu from about 36°N, 147°E, northeastward to about 45° to 48°N, and 178°E.

EXTRATROPICAL CYCLONES. The principal area of cyclogenesis stretches from south of Kyushu northeastward to about 700 mi south of Beringa Island. A primary track from across Sakhalin Island combines with the one above and follows the Aleutian Islands into the Gulf of Alaska. About 180°, a branch shoots off to the northeast toward, and over, the Pribilof Islands. About midway between Hawaii and Adak, a track points northeastward toward Yakutat. A secondary cyclone path enters British Columbia near the southern tip of the Queen Charlotte Islands. The storm tracks have moved slightly northward over the western waters. The intensity of the storms has started to decrease, resulting in fewer gales.

TROPICAL CYCLONES. In an average 10-yr period, about seven tropical storms can be expected over Far Eastern waters. About 80 percent of these, or 4 out of 5, have developed to typhoon strength. Tropical cyclones develop in the same region as they did in March, east of the central and southern Philippines and west of 170°W, but the area affected by these warm-core storms has expanded northwestward to include the waters east of Luzon and around Taiwan. A tropical cyclone in the eastern North Pacific in April would be a rarity.

SEA HEIGHTS. The area where there is at least a 10-percent frequency of 12-ft, or higher, seas is roughly bounded by 155°E and 150°W on the west and east, 52°N on the north, 32°N on the southwest corner, and 45°N on the southeast. An area of 10-percent frequency of swells equal to, or greater than, 12 ft parallels the coastline of North America, including the Aleutian Islands, and joins the western half of the above area.

VISIBILITY. Reduced visibility (less than 2 mi) of 10-percent, or greater, frequency extends to the north of a line drawn from Sakhalin southeastward to about 40°N, 160°E, and then east-northeastward to about 45°N, 175°W. From there the line swings northward to Amlia Island in the eastern Aleutians, and then eastward to about 50°N, 150°W, before cutting back across the Alaska Peninsula to the Bering Sea, east of St. Lawrence Island. The area of 20-percent frequency has decreased in size since March and is now centered over the northern Kurils.

NORTH ATLANTIC, MAY

WEATHER over the North Atlantic continues to moderate during May. The Azores High builds slightly to a central pressure of 1022 mb near 31°N, 40°W, while the Icelandic Low centered several hundred miles southeast of Greenland's southern tip fills to about 1012 mb.

WINDS over the greater part of the ocean between 40° and 55°N are generally westerly, except northeasterly over the Baltic Sea, but with less persistence than earlier in the spring. The average windspeed north of 40°N is force 4. Winds are quite variable between 55° and 60°N and are generally northerly north of 60°N. Between 25° and 40°N, winds are somewhat lighter, generally of force 3. West of 40°W, within the above latitudinal belt, south and southwest winds tend to prevail; while east of this longitude, winds from the northerly quarter of the compass are by far the most frequent of all. Over Mediterranean waters, west-northwesterly winds of force 2 to 3 are the most common. The Gulf of Mexico plays host to easterly force 3 winds. The "northeast trades," force 3 to 4, dominate the wind regime between 5° and 25°N, except along the African coast, where they extend northward to about 30°N. South of 5°N to the Equator, the force 2 to 3 winds almost always have an easterly component.

EXTRATROPICAL CYCLONES continue to develop frequently from off the Carolina coast northeastward to Newfoundland, but are becoming less severe. The direction of movement from Newfoundland is generally

either north toward the Davis Strait, or northeast toward the Norwegian Sea. Two primary tracks affect the Great Lakes. One runs east-southeastward from Lake Winnipeg to south of James Bay. Another follows a line from eastern Iowa across southern Lake Michigan and southern Lake Huron to lower Quebec. After meeting, the two tracks proceed as one to the Gulf of St. Lawrence.

GALES are rare below 40°N, and their frequency and duration in higher latitudes are less than in the preceding months. The area of maximum likelihood of gales, 10 to 20 percent, generally is located from the southern tip of Greenland southward to about 52°N, between 40° and 56°W.

TROPICAL CYCLONES are infrequent during May. During the 49-yr period 1931-1979, eleven tropical storms have occurred, and two of them attained hurricane force.

SEA HEIGHTS of 12 ft or more are encountered from 5 to 10 percent of the time along the northern shipping lanes, from several hundred miles east of the Chesapeake Bay to the northern Norwegian coast, excluding the North Sea and the Bay of Biscay, but including the Gulf of Lions southeastward to Sardinia. The frequency increased to more than 10 percent in the midocean area and to more than 20 percent south of Kap Farvel.

VISIBILITY limited to less than 2 mi is encountered 10 to 20 percent of the time over the western North Atlantic, from about 40°N, 65°W, northeastward to a point near 53°N, 30°W, and then westward to the Labrador Sea. The line, north of which frequencies are greater than 10 percent, but less than 20 percent, then extends northeastward over Kap Farvel to north of Iceland, and through the Norwegian Sea to the Barents Sea. Visibility less than 2 mi also occurs between 10 and 20 percent of the time over a great part of the northeastern North Sea. Frequencies increase to over 20 percent of the time over the Grand Banks and off the southwest coast of Greenland.

NORTH PACIFIC, MAY

WEATHER continues to improve slowly over the North Pacific in May. The subtropical High has an average central pressure of about 1022 mb and is located near 34°N, 152°W. The Aleutian Low becomes a broad weakening trough extending from the Asian mainland eastward to the western Gulf of Alaska. The lowest pressure, about 1008 mb, is centered over the west-central Bering Sea.

WINDS north of the 25th parallel tend to come from the westerly quarter of the compass, but variable winds are present over a number of locations on either side of the dateline. Winds over the Gulf of Alaska are easterly at force 3 to 4. Along the coast of the United States, northwesterly components are pronounced. Between the Equator and 25°N, (30°N, east of 180°), the "northeast trades" are very steady, except over the southern half of the South China Sea, where southerly winds of the southwest monsoon have established themselves. These monsoon winds are usually force 2 to 3, though lighter winds are not unusual. Over most of the rest of the North Pacific, windspeeds average force 3 or 4. Northerly and westerly winds prevail out from the Gulf of Tehuantepec, with easterly and northwesterly winds close behind. Speeds are force 2 or 3, 48 percent of the time.

EXTRATROPICAL CYCLONES continue to develop over the Ryukyus and then move east-northeastward toward the Gulf of Alaska. A second primary storm track crosses the Siberian coast and Sakhalin, continues eastward across the northern Kuril Islands, and then curves toward the southern Bering Sea.

GALES decrease in frequency. In midocean between 40°N and the Aleutians, the chance of encountering gale-force winds remains slightly above 5 percent. Two smaller areas of similar frequency are found near the Alaska Peninsula and over the southern part of the Gulf of Alaska.

TROPICAL CYCLONES. Tropical storms occur, on the average, slightly more than once each year over the western ocean. There have been some years with none, but some with as many as four. Roughly 75 percent of these tropical storms become typhoons. The areas of most frequent development are south of 20°N, from the Carolines westward across the Philippines and the South China Sea. About once every 2 yr, a tropical storm or hurricane develops over the ocean area off Mexico during May.

SEA HEIGHTS. Seas of 12 ft or more continue to decrease in frequency as the winds decrease. The area of 10 percent or greater has the shape of a long balloon squeezed in the middle. The northern boundary parallels the Aleutian Islands about 400 mi to the south, between 160°E and 148°W. The southern boundary is 40°N over the western, and 45°N over the eastern ocean. High swells continue to be observed off the Asian and northern coasts, with a larger area in midocean very roughly bounded by 30° and 50°N, 155°E and 170°W.

VISIBILITY less than 2 mi occurs more than 10 percent of the time over the western North Pacific Ocean north of 35°N, and over the eastern North Pacific Ocean north of 42°N and west of 140°W, excluding the Gulf of Alaska and the waters southeast of the central Aleutians. Over the northern Kurils, this low visibility occurs more than 30 percent of the time.

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TROPICAL CYCLONE NAMES FOR 1980

North Atlantic		Eastern Pacific		Western Pacific	
Allen	Nicole	Agatha	Newton	Carmen	Percy
Bonnie	Otto	Blas	Orlene	Dom	Ruth
Charley	Paula	Celia	Paine	Ellen	Sperry
Danielle	Richard	Darby	Roslyn	Forrest	Thelma
Earl	Shary	Estelle	Seymour	Georgia	Vernon
Frances	Tomas	Frank	Tina	Herbert	Wynne
Georges	Virginie	Georgette	Virgil	Ida	Alex
Hermine	Walter	Howard	Winifred	Joe	Betty
Ivan		Isis		Kim	Cary
Jeanne		Javier		Lex	Dinah
Karl		Kay		Marge	Ed
Lisa		Lester		Norris	Freda
Mitch		Madeline		Orchid	

Central Pacific names were not available at press time. They will be printed next issue.